JOURNAL OF THE

SMPTE

375 **The Society and Education — Twelve Papers on the Audio-Visual and Nontheatrical Film Field**

Operations Research on Instructional Films • *Loran C. Twyford, Jr.* — New Perspectives for the Use of Film in Teaching • *Sol Roshal* — Responsibilities of Classroom Film Producers • *Alan Kellock* — An Experimental Evaluation of Sound Filmstrips vs. Classroom Lectures • *Solomon Dworkin and Alan Holden* — An Experimental Film-Rental Plan to Aid Teacher Education • *Ellsworth C. Dent* — Scope and Nature of Nontheatrical Films in the U.S. • *John Flory and Thomas W. Hope* — The Challenge Facing the American Film Producer • *Henry Ushijima* — Producing the Sponsored Documentary Film • *Henry Ushijima* — Low-Cost Movies for Business • *Fred A. Denz* — Filming for Educational Television • *David W. Johnson* — Implications of Continental Classroom for Open-Circuit Television Teaching • *Edwin P. Adkins* — Projector Noise Levels • *G. E. Whitney, M. T. Buckelew, J. F. McGrane and M. L. Baron*

407 The Soundtrack in Nontheatrical Motion Pictures (Part II — Editing the Component Parts of the Soundtrack) • *Frank Lewin*

413 A New Television Opaque Projector Designed by Radio Tokyo, JOKR-TV • *Eizo Suyama*

415 Application of a Liquid Layer on Negative Films to Eliminate Surface Defects in Optical Printing • *R. H. DeMoulin, P. A. Ripson, Jr. and S. L. Scudder*

417 Color Exposure for High-Speed Photography of Some Events Requiring Artificial Illumination • *K. H. Lohse*

422 Errata: Progress Report

422 Proposed American Standard: Film Spools for 8mm Motion-Picture Cameras

424 Excerpts of Speeches at Miami Beach • *N. L. Simmons – Mitchell Wolfson*

86th SMPTE Convention • October 5–9 • Statler Hilton, New York

volume 68 • number 6 **JUNE 1959**

JOURNAL of the
SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

PUBLICATION OFFICE TWENTIETH AND NORTHAMPTON STREETS EASTON, PA.

Officers

President, 1959–60
NORWOOD L. SIMMONS, Eastman Kodak Co., 6706 Santa Monica Blvd., Hollywood 38, Calif.

Executive Vice-President, 1959–60
JOHN W. SERVIES, National Theatre Supply Co., 92 Gold St., New York 38, N.Y.

Past-President, 1959–60
BARTON KREUZER, Astro-Electronic Products Div., Radio Corporation of America, Princeton, N.J.

Engineering Vice-President, 1958–59
AXEL G. JENSEN, Mee Dr., Berkeley Heights, N.J.

Editorial Vice-President, 1959–60
GLENN E. MATTHEWS, Research Labs., Bldg. 59, Kodak Park, Eastman Kodak Co., Rochester 4, N.Y.

Financial Vice-President, 1959
G. CARLETON HUNT, General Film Labs., 1546 N. Argyle Ave., Hollywood 28, Calif.

Convention Vice-President, 1959–60
REID H. RAY, Reid H. Ray Film Industries, 2269 Ford Pkwy., St. Paul 16, Minn.

Sections Vice-President, 1958–59
ETHAN M. STIFLE, Eastman Kodak Co., 342 Madison Ave., New York 17, N.Y.

Secretary, 1959–60
WILTON R. HOLM, E. I. du Pont de Nemours & Co., Parlin, N.J.

Treasurer, 1959
S. P. SOLOW, Consolidated Film Industries, 959 Seward St., Hollywood 38, Calif.

Governors, 1958–59
JOSEPH E. AIKEN, 116 N. Galveston, Arlington, Va.
DON M. ALEXANDER, Alexander Film Co., Colorado Springs, Colo.
HERBERT E. FARMER, 7826 Dumbarton Ave., Los Angeles 45, Calif.
ALAN M. GUNDELFINGER, Technicolor Corp., 6311 Romaine St., Hollywood 38, Calif.
W. W. WETZEL, 725 Ridge St., St. Paul, Minn.
DEANE R. WHITE, Photo Products Dept., E. I. du Pont de Nemours & Co., Parlin, N.J.

Governors, 1959–60
GERALD G. GRAHAM, National Film Board of Canada, Box 6100, Montreal 3, Que., Can.
THEODORE B. GRENIER, 2045 DeMille Dr., Hollywood, Calif.
UB IWERKS, 4500 Mary Ellen Ave., Sherman Oaks, Calif.
KENNETH M. MASON, Eastman Kodak Co., Prudential Bldg., Room 2006, Chicago 1, Ill.
ROBERT C. RHEINECK, CBS, 485 Madison Ave., New York 22, N.Y.
JAMES L. WASSELL, 927 Harvard Lane, Wilmette, Ill.

Governors and Section Chairmen, 1959
JEROME C. DIEBOLD, Wilding Picture Productions, 1345 Argyle St., Chicago, Ill.
ROBERT G. HUFFORD, Eastman Kodak Co., 6706 Santa Monica Blvd., Hollywood 38, Calif.

Section Chairmen
R. J. BEAUDRY, Shelly Films Ltd., Toronto, Ont., Canada
B. M. LODEN, Box 37, North Side Branch, Atlanta, Ga.
WILLIAM R. McCOWN, P. O. Box 6215, Nashville, Tenn.
JAMES A. MOSES, 1202 Oberlin Dr., Bucknell Heights, Alexandria, Va.
W. A. PALMER, W. A. Palmer Films, Inc., 1895 Oak Ave., Menlo Park, Calif.
ERWIN J. PATTIST, 3618 Marsh Lane Pl., Dallas, Texas
RICHARD E. PUTMAN, 420 East Corey Rd., Syracuse, N.Y.
EDWARD H. RIDEOUT, Avco R & A D, 750 Commonwealth Ave., Boston, Mass.

Editorial Office

55 West 42d St., New York 36, New York

Editor—VICTOR H. ALLEN
Advertising Manager—DENIS A. COURTNEY

BOARD OF EDITORS

Chairman—PIERRE MERTZ
66 Leamington St., Lido, Long Beach, N.Y.

HARLAN L. BAUMBACH	CLYDE R. KEITH
D. MAX BEARD	W. I. KISNER
GERALD M. BEST	RALPH E. LOVELL
GEORGE R. CRANE	C. DAVID MILLER
HAROLD E. EDGERTON	HERBERT W. PANGBORN
CARLOS H. ELMER	BERNARD D. PLAKUN
CHARLES R. FORDYCE	WALDEMAR J. POCH
LLOYD T. GOLDSMITH	ALLAN L. SOREM
LORIN D. GRIGNON	JOHN H. WADDELL
A. M. GUNDELFINGER	DEANE R. WHITE
CHARLES W. HANDLEY	W. T. WINTRINGHAM
RUSSELL C. HOLSLAG	CHARLES W. WYCKOFF
EMERSON YORKE	

Papers Committee Chairman—BERNARD D. PLAKUN
63 Bedford Rd., Pleasantville, N.Y.

Subscriptions to nonmembers, $12.50 a year (outside continental United States, add $1.00 for postage); subscribers residing in countries which participate in UNESCO may use UNESCO coupons in submitting subscription payments in the event other means of remitting are not available; single copies, $2.00 for one-part issues, $2.50 for special two-part issues. A 10% discount is allowed to individual members and accredited agencies on orders for subscriptions and single copies. A list of priced and gratis publications is available. Order from the Society's Headquarters Office, 55 West 42d St., New York 36.

THE SOCIETY is the growth of over forty years of achievement and leadership. Its members are engineers and technicians skilled in every branch of motion-picture film production and use, in television, and in the many related arts and sciences. Through the Society they are able to contribute effectively to the technical advance of their industry. The Society was founded in 1916 as the Society of Motion Picture Engineers and was renamed in 1950.

Membership in Sustaining, Active, Associate or Student grades is open to any interested person according to his qualifications. Information about membership, technical activities and standards and test films for the industry is available from Society Headquarters. Members residing in countries which participate in UNESCO may use UNESCO coupons in submitting membership payments in the event other means of remitting are not available.

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

Headquarters Office: 55 West 42d St., New York 36, N.Y. Cables: Somopict Telephone: LOngacre 5-0172

Executive Secretary: CHARLES S. STODTER

Published monthly by the Society of Motion Picture and Television Engineers. Publication office 20th and Northampton Sts., Easton, Penna. Second-class mail privileges authorized at Easton, Penna. This publication is authorized to be mailed at the special rates of postage prescribed by Section 132.122.

Copyright 1959, by the Society of Motion Picture and Television Engineers, Inc. Permission to republish Journal text material must be obtained in writing from the Society's Headquarters Office, 55 West 42nd St., New York 36. The Society is not responsible for statements of contributors.

Printed by Mack Printing Company, Easton, Pa.

Journal of the Society of Motion Picture and Television Engineers

VOLUME 68 • NUMBER 6 • JUNE 1959

The Society and Education

The Society's interests and its planned contributions to education have been variously noted at the two most recent Conventions.

At Detroit, Maurice B. Mitchell of Encyclopaedia Britannica Films noted: "Audio-visual education began in 1928 in the Paramount Theater in New York City . . . (with) Al Jolson singing 'Mammy' in the first sound picture ever made. This spectacle opened the way for educators handicapped by apparently insoluble problems in communication and education. . . . In films giving all students experience in common, the teacher has found for the first time a device for establishing this precious uniform background."

Also at Detroit, President Barton Kreuzer in his speech of welcome especially noted the work of the Education Committee under Chairman John Frayne, and he called attention to the "thirty-one TV stations in the U.S.A. devoted exclusively to educational purposes."

At Miami, President Norwood Simmons spoke of the SMPTE Committee to study the responsibilities of the Society toward meeting the needs of Science and Education, the formation of which was "prompted by the interest of our members in the passage by our Congress of the National Defense Education Act, . . ." He suggested that "It is possible that engineers from SMPTE will be called upon to help plan the schoolroom of tomorrow. . . ."

Mitchell Wolfson, addressing the Convention at Miami, discussed chiefly the broader aspects of education, particularly the role of SMPTE in the field of international communication. He said, "I believe it would take perhaps a thousand years for all the peoples of the world to learn a common language . . . so you can see why I feel expansively encouraged at knowing that you are on the threshold of overcoming mankind's most frustrating and, so far, hopeless social inability to communicate."

Also at Miami, Major General J. B. Medaris devoted a portion of his address to a detailed discussion of the use of film and television in military training programs. He said, "We may have come upon a process of immense value in the training programs of large corporations and other agencies of government. It should certainly appeal to those responsible for public education, particularly since the ability of this system to increase teacher effectiveness has been demonstrated."

There follows a group of papers from the Detroit Convention, especially pertaining to the audio-visual and nontheatrical film interests of the Society. Papers variously covering education, television and films will be published in subsequent issues of the *Journal*.

Operations Research on Instructional Films

By LORAN C. TWYFORD, JR.

The needs for instructional films and how these needs are being met can be thought of as one operation. The factors in this operation include sound, picture, motion, color, cost, ease of preparation, use and maintenance, as well as other less important considerations. Instructional film research provides the guidance for evaluating the relative importance of these factors and points to films and equipment design considerations.

THE METHODS for making instructional films and the equipment for showing them have recently been questioned as a result of research studies carried out by military and civilian educational institutions. The purpose of this operation analysis is to integrate these research findings into a form that can assist in the planning for new film types and new equipment that will most adequately meet the needs for instructional films.

Presented on October 21, 1958, at the Society's Convention at Detroit by Loran C. Twyford, Jr. (then at Michigan State University, Audio Visual Center, East Lansing, Mich.)—Dr. Twyford is now Consultant on Educational Communication with the New York State Dept. of Education, Albany 1, N.Y.

(This paper was received on September 22, 1958.)

Media Factors

The purpose of instructional films is primarily that of promoting learning by the viewer. Although much has been said concerning the value of the picture in promoting learning, research by Nelson and Moll and that of others seems to indicate that sound is the most important element in the average instructional film. The picture without sound may be quite unintelligible. One study suggested that about 70% of the learning was imparted by the soundtrack alone, and this percentage was found for a film on aerodynamics, which is probably much more visual than the average film. The contribution of the soundtrack in the average film may approach 85%, although there is no research to substantiate this.

But sound alone has its limitations. Tape recordings and disks have been found effective for instruction, but they lack the ability to direct the attention of the listener, thus securing his more concentrated study. One of the advantages of educational television over educational radio lies in its ability to command visual attention even when the camera shows only the face of the instructor. Sound is therefore the medium by which a large part of the educational message of a film can be transmitted. Much research has been conducted on the optimum characteristics of this message. The Pennsylvania State University, under contract to the U.S. Naval Training Devices Center, has conducted over 65 controlled experimental studies that

Media Factors	Production Factors	Utilization Factors
1. Sound	1. Complicated production	1. Essential films
2. Picture	2. Effect of costs	2. Filmed courses
3. Motion	3. Types of production	3. Room darkening
4. Attractiveness	4. Low cost production	4. Film rental cycle
		5. Projector limitations

Fig. 1. Factors in instructional film operation.

bear on this and other aspects of instructional film production and use.[1]

The second basic need in an instructional film is a picture or visual presentation. The picture becomes indispensable for showing something new that cannot be easily visualized by the learner. A number of studies show that learning results from exposure to visual material. Silent films have been shown to be effective instructional materials, but by itself the pictorial material is lacking in its communicability.

One of the most important implications of research findings concerns the absence of any significant decrease in learning as a result of degrading picture quality or pictorial content. Color in a film may make some difference in learning outcomes, but even in the most dependent cases this learning differential is very small. Stereoscopic films were not found to improve the learning of a motor skill where depth perception would appear to be most useful. As much learning occurred from a film lacking optical effects as from one having them. Learning from very early kinescope recordings which had very poor resolution was as great as from the films which were televised.

It is relatively easy to record sound with a tape recorder, or to make slides and show the pictures by means of projectors. The provision of motion in an instructional film, however, increases costs in production and utilization. How important is motion in an instructional film? The large number of film-strip users attests to the low value ascribed to this factor. Also, filmographs, which are sound films employing still material, have been found to be as effective as a regular motion picture. Nevertheless, the attention value of a motion picture is probably greater than that of still pictures.

Although the primary purpose of instructional films is to promote learning, there are certain affective factors that must be considered. Members of an audience are not necessarily attracted to the film material; they may be a "captive" audience required to watch the film. An important aspect of color is its attractiveness. Realistic situations are also portrayed in films, although the need for doing so has not been demonstrated. Dramatic presentations increase interest but have not been shown to be more effective than a film utilizing a straightforward factual approach. On the basis of present evidence it would appear that most of these affective factors may be eliminated or greatly reduced without decreasing learning potential.

Production Factors

As a result of the employment in instructional films of the factors of sound, picture, motion and often color, the production of films has become complicated. The provision of motion necessitates that many pictures be produced with expensive equipment operated by skilled personnel. The provision of sound on the same film complicates production, although it probably simplifies utilization of the films. The use of 16mm film to provide requisite brightness rather than 8mm also adds to basic production costs.

Therefore, even the simplest single-system sound film is expensive as contrasted to the tape recording or filmstrip. As a result, in order to sell instructional sound films, it has been necessary to make them especially attractive and to provide specially treated instructional material. This involves the participation of subject-matter experts to obtain an accurate product. Consequently, these expensive films must be made to reach as wide a market as possible, even though film research indicates that the film should be specifically directed to the student's needs. In addition, the film may take two years to produce, making it unavailable for instruction dealing with current events. The sale of the instructional film is also affected by competition with theatrical films and television programs that must attract its intended viewers. Therefore the cost of instructional films may be increased because more elaborate film techniques must be used for them.

Instructional films can profitably be compared with books. Instructional books range from magazine and science newsletters, paper-bound books, textbooks and reference books to encyclopedias. Because of the high cost of sound films, most instructional films are comparable to encyclopedias that cover the important aspects of a topic but usually do not deal with the topic in depth. Recently the military services have made films that correspond to newsletters and paper-bound books. These films have the advantage of being specific in content, being low in cost, and having an extremely short production time. Because of their low cost they can be used on a local basis to meet local needs.

Films of instructional television programs are now competing with instructional films. The physics series distributed by Encyclopaedia Britannica Films, Inc., are films taken during a television course. A large number of kinescopes are currently being made available in schools for instructional purposes.

Utilization Factors

Until recently films have been considered as visual aids to education, with the teacher always controlling the instruction. The film served as an auxiliary but not an indispensable tool. It could be used like an encyclopedia to survey the subject, but one could not really learn from it. Naval research revealed what an instructional film should contain, and some films now being made have a specific teaching job to perform.[2,3] The Department of Audio-Visual Instruction of the National Education Association now promotes instructional materials rather than visual aids and thinks of films as teaching tools.

The teacher shortage of the past years has led to a realization that films and television can perform the entire teaching function. Research during the past ten years proves this to be so. When films are utilized in this manner they are justified on the basis of their own contribution rather than as an aid. However, a course of instruction on film is almost prohibitively expensive. The physics course is used by a number of schools on a circuit to reduce costs. Many films used in our schools must be rented from a central library because they are too expensive to be owned locally. Even the most inexpensively filmed courses would be more expensive than would be desired for the film to take a firm central position in our educational structure.

Since films are so often used as aids rather than as integral instructional units, it is important to learn why this is so. This is partly true because films must be widely sold to justify their cost.

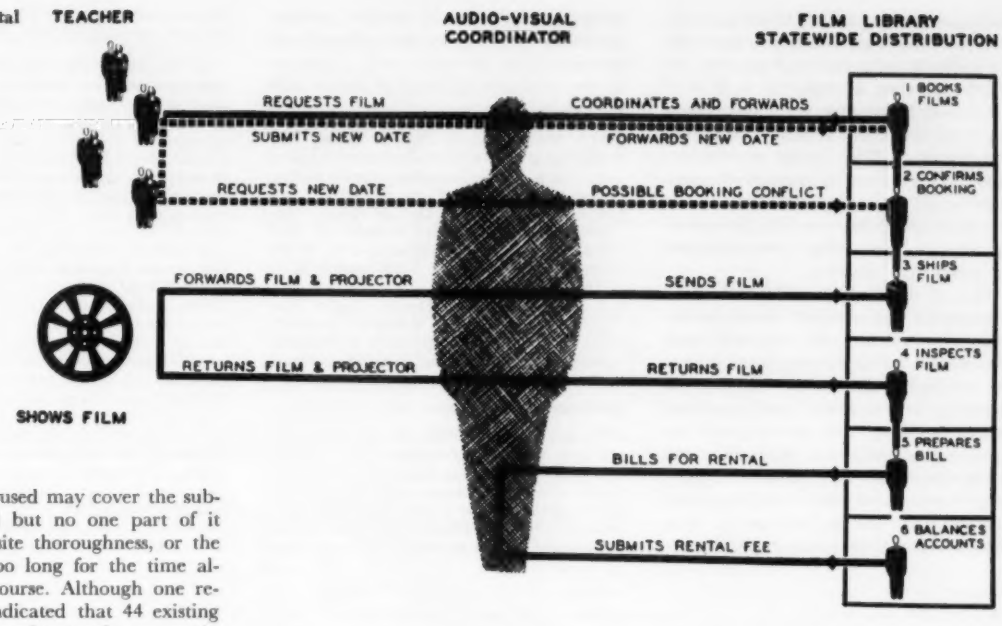


Fig. 2. Film rental operation.

Often the film used may cover the subject in general but no one part of it with the requisite thoroughness, or the film may be too long for the time allotted in the course. Although one research study indicated that 44 existing films could be used to teach a course in general science, there is little indication that films used in this manner are as effective as ones that might be produced specifically for this purpose.

The use of films in the classroom is not easy. The greatest difficulty is in darkening the room. Usually rooms are designed to afford a maximum of window space. At best, arranging to show a film in class is time-consuming and disruptive, and often poorly ventilated rooms become uncomfortable. However, learning from the film is probably as good and often is better than that provided by the teacher.

Obtaining a film for a showing involves extensive communication (Fig. 2). A teacher requests a film of the audio-visual coordinator. He compares her request with others and writes to a film library for the film, if it is unavailable for the date specified, he gives an alternate date. The library confirms the order and ships the film to the coordinator, who sends it with a machine and operator to the classroom. The operator waits until an appropriate time and then shows the film. Although the teacher may know something about operating a projector, the uncertainties of projection cause her to request an operator. Then the film is mailed back to the library and the school is billed for the rental charges (which are generally thought to be exhorbitant). The above procedure is idealized since the film is often unavailable, must be ordered as long as a year in advance, is damaged, or is projected under poor conditions.

The high cost of sound projectors also limits their usefulness. Projectors must be centrally controlled for efficient use, and arrangements must be made for each showing. All projectors are too noisy for classroom use. This has become apparent in comparison with closed-circuit television. A motion-picture projector can throw a small picture as bright as that on a television set, but the projector noise near the screen and speaker is objectionable. Projector noise necessitates higher sound volume and makes it more difficult to hear well. A 24-in. television set was found to be more satisfactory for showing films to a class of 30 students than a motion-picture projector because windows could be left open to improve ventilation.

Projector design is very poor. Teachers can learn to thread projectors, but they soon forget and are confused by new models or specific difficulties encountered with particular machines. Specifically, the sound projector has not been human-engineered. The threading path is far too complex and the number of controls and possible adjustments that can be misadjusted is excessive. Although film magazines and self-threading projectors may offer some improvement, a projector with no more complexity than a tape recorder is desirable.

The projector cannot be used alone to show a sound picture. One requires a projector stand and screen and a place to put the speaker. These complications would not be present if a sound projector, screen and speaker were incorporated in one unit like a television set. Rear-screen projectors presently approach this ideal, but they are noisy and are not human-engineered.

Knowing these strengths and weaknesses of the factors involved in instructional films, it is now possible to isolate the more important factors as design centers for an improved instructional film operational system.

Model of an Instructional Film System

With the aid of research findings and some judgment, it is possible to unite the crucial factors into an ideal system. Sound and pictures must be provided at a cost not much greater than that of tapes and filmstrips. The greatest possibility for achieving this appears to be in reducing the provision of motion. The sound slidefilm is in this category, although there appears to be little standardization of this type of equipment. This may have reduced its acceptance. If courses of instruction can be acceptably put on sound slidefilms, this type of instructional film will have great possibilities. The Pennsylvania State University is presently conducting research on this problem for the U.S. Navy.

If sound, picture and motion are incorporated in the system, it would appear that projector redesign is desirable. For the average classroom a 24-in. screen should be adequate if the picture is sufficiently brilliant. The resolution of 8mm film is probably adequate for instructional purposes, but the light intensity on the screen is a critical factor. The screen, speaker and film mechanism must be incorporated in a truly portable case. The film should fall in a slot without threading and should be capable of fast shuttling for reshowing of specific sequences. The projector mechanics should be very simple to reduce costs and maintenance. The amplifier should employ transistors, and a simple one-control switch should be provided. The projector should be noiseless in operation.

Present film materials are too expensive to produce and process. There are several new film materials that can be used to advantage if they are properly

developed and exploited. Color appears to be desirable even if it is not essential, and it should be provided if practical in a field-sequential scheme.

It should be possible to produce films locally at low cost on entire segments of instruction. This would permit revision by instructors as content changes. Films would be used for direct instruction, and the instructor would devote his time to preparing new material and counseling students.

What is the desired goal of an ideal instructional film system? There should be a projector in each classroom and films should be as numerous as books. The projector should be capable of operation by students and teachers without training and should have no maintenance problems. Certain films should be made by national experts while others should be made economically by local teachers for use in their schools. When these ideals are obtained, instructional films will assume a more dominant position in our educational structure.

References

1. U.S. Naval Training Devices Center, "Instructional Film Research Reports," Navexos P-1220, a compendium of 35 research studies, Port Washington, N.Y., January 1953.
2. U.S. Naval Training Devices Center, "Instructional Film Research Reports, Vol. II," Navexos P-1543, a compendium of 29 research studies, Port Washington, N.Y., June 1956.
3. U.S. Naval Training Devices Center, "Instructional Television Research Reports," Navexos P-1544, a compendium of 7 research studies, Port Washington, N.Y., June 1956.

Discussion

Chauncey L. Greene: (*RKO, Minneapolis*): I have not been in the visual education field recently but when I was it seemed that the degradation of quality of the screen image materially shortened the length of time over which the students would maintain mental acuteness. In reference to your statement of the comparatively small importance of image quality, what was the length of the teaching period at the time that the data was being gathered?

Dr. Twyford: I believe this information comes from our experience with instructional television using the very inexpensive vidicon cameras. A great deal must depend upon the detail that must be present in the pictorial image. If fine printing or much detail in equipment is to be shown, then certainly you would want very good detail in the picture; however, television, with its lack of quality, particularly with some of the vidicon cameras, has proved quite successful when used over periods of one hour — which is usually sufficient for most educational purposes.

Alan Kellock (*McGraw-Hill Text-Film Dept.*): You noted the growing importance of the sound filmstrip as a means of instruction but I believe you did not mention the possibility of individuals using filmstrips through the use of the filmstrip viewers, either silent or sound. Has your research developed any information along this line?

Mr. Twyford: There is not much information in that area. My own reaction to your statement is that the cost of equipment must be justified in the educational scheme of things. From this viewpoint it is important that the film itself do an entire teaching job. I believe that individual viewers have their place more as accessary than as essential instructional devices.

New Perspectives for the Use of Film in Teaching

By SOL ROSHAL

To meet educational requirements, film production must branch out in two main directions away from present practice. Short, specific films which can be used more flexibly by the teacher and student are needed as well as those which can be used to carry a complete lesson; and the use of such films requires new distribution procedures and new projection equipment.

Since the earliest days of motion-picture production, possible uses of film for educational purposes have been considered and evaluated. Even Thomas Edison made large claims and ambitious predictions for the use of the motion picture as an instructional medium. But in spite of this long history of trial, experiment and discussion, the instructional possibilities of film have hardly been exploited. There is need for, and there is justification for, wider and more intensive use of film.

Merely broadening the area of application provides, of course, insufficient enhancement of any given scientific or technological field, and thus for fuller realization of the film in education, there must be new perspectives and new developments both in the film itself and in the way it is used. This paper describes new directions which, it is believed, hold great promise: two new genre of films, true film libraries and new projection equipment.

There are certain psychological and sociological reasons for the historical neglect of these "perspectives," but these would not be good arguments for continued neglect. The requirements of teaching systems logically demand further and accelerated development in these directions.

Film for Exact Needs

The first of the two genre of films is a class of short specific films designed to meet definite or limited instructional needs or objectives. If the need is to teach the tightening of a nut with a particular wrench, the requirement is for a film which teaches or demonstrates the tightening of a nut with that wrench, not a film on the care and treatment of hand tools, nor one on the development of tools, nor even one simply titled *Wrenches*.

A student wants to know how a lumberman cuts down a tree. His teacher can find films which tell about our wonderful forests, the lumber industry, the economic and social aspects of trees, and the marketing and uses of wood. One or more of these films will show trees being cut down, but a piece of film which just shows how a lumberman fells a tree is not available to the teacher.

Why should the teacher want this little piece of film? Why not make the interest in felling a tree the occasion, the motivation, for a broader learning experience? The answer depends upon what the teaching objectives are. In engineering terms: "What are the specs?"

An engineering model should serve well to illustrate this point. The film which is characteristically available, at present, from the educational film distributor is an off-the-shelf black-box. It happens that effective systems can be and are built by the simple assembly of off-the shelf components. More often, the available components must be adapted to the system requirements by such devices as matching amplifiers and transducers. In education, courses can be and are made up of available materials, but usually the instructor supplies the mating elements to tie and integrate the film he uses into his lesson plan.

Further, a design engineer would be very unhappy if he could not buy smaller pieces than black-boxes — he wants to buy tubes, resistors and transformers. He would assemble some pretty cumbersome systems if he were limited to using only available black-boxes. The teacher, too, very often finds himself in the position of needing a small element — a little piece of film to illustrate a single idea or explain a single concept.

Another kind of illustration of the need for these short films may come from looking at an encyclopedia. An encyclopedia

Presented on October 21, 1958, at the Society's Convention at Detroit by Sol Roshal, Planning Research Corp., 10966 Le Conte Ave., Los Angeles 24.
(This paper received in final form June 1, 1959.)

has both short and long articles. Some articles are two or three pages long while others are only two or three, or even one paragraph long. The filmed counterpart would have films 10 or 20 minutes long and others 2 or 3 minutes long.

The idea of a filmed encyclopedia is, incidentally, intrinsically interesting and would constitute a useful project. Large parts of the encyclopedia, mainly the longer articles, could be assembled from existing releases. The short articles would have to be produced, for they have not been made.

Suggestions for Short Films

There may be great difficulty in convincing educational film producers to make these short films because they will not see these bits as marketable units. Indeed, these short films would have an impossible price if the distribution costs for a one-minute film ran to the present distribution costs for a one-reel film. Possibly a solution may be found by borrowing again from printed matter practice. Several short films might be packaged together as volumes and the volume would be the marketing unit. The encyclopedia mentioned above may be a solution or, at least, provide a rationale for the definition of "volumes." Another possibility may lie in the package of text-correlated films — that is, a group of films designed to go with a particular textbook.

The Complete Course on Film

The other class of films takes off mainly in the opposite direction — longer films than are typically available. There are few films or sets of films which are designed to carry a complete course of study or even a complete lesson unit in and by themselves. When this issue is raised, two questions come immediately: "Do we need such films?" and "Can films be built which will do a complete teaching job without a teacher?"

While there is great controversy as to whether there is or is not a shortage of teachers, many educators contend that not only is there a shortage but that there will be an increasing one. Others believe there would not be a shortage if available teachers were used efficiently. Without entering the controversy, suffice it to say that there are courses, especially science courses, which are missing from the curricula of many schools simply because teachers are not available to teach these courses. All seem to agree that these courses should be taught, and so some way must be found to do it. One route may be through film.

The second question "Can films be built which will do a complete teaching job without a teacher?" is hard to answer in that form. The word "complete" makes it tricky. This is like asking, "Can you build a perfect amplifier?" The answer to the question in that form is "No." There will always be the possibility of building a better one. But given a set of specifications, the question takes on a new character. You might or might not be able, today, to build an amplifier which will meet a particular set of specifications. The same applies to the instructional film. If instead of complete, you specify a set of performance characteristics, you may or may not be able to fulfill the requirements at any particular state-of-the-art. There is no doubt that you can build films that will do various and effective teaching jobs.

The notion of the self-sufficient film in the context of industry has some very interesting implications. Though not necessarily for the same reasons as our schools, industry, too, has teacher shortages. The film offers industry not only a tool for increasing the efficiency of training but, also, a means for reducing the training requirement.

One approach to job simplification is through the development of job-aids. Here, too, the film can be useful. Picture some sequence of job operations and imagine a step-by-step film demonstration of the work procedures. This is the job-aid. Good job-aids may guide an unskilled or a semiskilled worker through his job, thus reducing or obviating the need for prior training in that job.

Film Libraries

The typical film library now in operation borrows little more than the name and some cataloging and recording procedures from the traditional library. What is needed is a true library — one really used by students and not just a warehouse for film. A film library should make films available for student use just as the traditional book library makes books available to the student as active learning tools.

Consider the use of a printed-matter library in the pattern of the typical school audio-visual library. This library is sacrosanct. Students may not enter. If they do enter, they certainly don't browse. Students aren't permitted to read books. Sometimes a student committee may read a book — under proper supervision. But a student does not get an assignment to read on his own and he is never sent to do research in the library. In fact, if there is some printed matter deemed important to the students, the teacher, or an "expert reader" will bring it to class and read it to them.

This is a fairly ludicrous picture, but it is true when "film" is substituted for "book" and, ludicrous though it is, it is a true description of today's audio-visual libraries. The educational requirement, however, is for broadening, not limiting, the avenues of exploration open to the student. The student must have films as well as books, pamphlets and magazines made available to him. That is, give the student the tools to do his job.

Film librarians may reasonably argue the dangers of admitting students who would, the librarians say, soon tear up all the film and clobber all the projectors. This is a problem of instrumentation. Obviously, some new equipment is required. It is neither a depreciation of the problem nor an idle joke to say "That's an engineering problem." Why not build projectors students cannot put out of order and make arrangements to prevent the destruction of film?

New Projectors

The specifications of the 16mm projector found in the average classroom were not generated by teaching or classroom needs. Rather, the objective has been to approach theatrical requirements and theatrical standards as closely as possible. There are available today 16mm projectors which can deliver theatrical quality, if the film has the quality. In general, approaching the 35mm standard means departing further from the classroom requirement.

A few years back, the writer directed an Air Force development project for the design of an instrument which would be suited to the use of the film in teaching.* We had in mind the use of film in the classroom, in self-teaching, in a true film library, and later, with the job-aid.

None of these is a theater situation — and the first requirement that this suggests is daylight viewing. The classroom has been darkened about as many years as film has been used in the classroom, but this is a poor procedure. If students are to do more than watch the film, that is, if they participate actively in the learning process, including old-fashioned note-taking, there should be some light on the subject. If the teacher is really to integrate the film into his teaching practice — and he should be able to use film as flexibly as he uses the blackboard — he cannot set up a theater every time he switches from lecture or discussion to film. Certainly when the filmed job-aid is considered, the idea of darkening the room must be abandoned.

The second requirement is ease of use. The time required for accomplishing the preliminaries to film viewing is wasted for teacher and students. Further, there should be no general requirement for all teachers to become expert projectionists. It is easy to find teachers who do not use film solely because they cannot use, or are uncomfortable with, the projector. For self-teaching, it is unreasonable to require projection as a student skill like reading and writing.

An allied requirement is that the handling of film should be strictly and rigorously limited to people who do have the skill. None but technicians should need to, or be allowed to, handle the film. In

* Of the Air Force researchers who contributed to the development of the viewer and filmed job-aids, mention should be made of at least A. A. Lumsdaine, A. J. Hoehn, and F. F. Kopstein.

the job-aid application, it is easy to see that a mechanic should not be able to get begrimed hands near the film.

And the equipment and system should allow incisive study of the film. At a minimum, this means flexibility in selection of portions for intense viewing and easy immediate reshowing. For this purpose, Polan Industries, of Huntington, W. Va., designed, for the Air Force, a self-contained suitcase sound viewer with integral screen and sealed magazine which is activated upon insertion of the magazine.

Other approaches are certainly possible and should be developed and evaluated.

Each of these perspectives should lead to advancement of the film in teaching. But equally important is the approach which led to the definition of the particular items. It can be described as the application of system engineering procedures to the problems of education. There never has been any formula for creativity, but solutions pertain to problems, and problems are set by functional requirements.

Discussion

Hartwell T. Sweeney (Eastman Kodak Co.): Do you consider it vital that educational films be run only at certain speeds, assuming that sound limitation is not necessary?

Dr. Roshal: No, nor do I think it necessary to insist that we have 24 frames for sound. But if we deviate from the accepted standard — in the industry — then more and more re-design becomes necessary. There are some who believe there should be complete re-design from the camera to the viewer. Perhaps we shall have some papers in the near future on this subject. It seems certain that if you have more than one speed, there should be no adjustment required by the teacher or the film viewer. The adjustment in motor speed should be automatic.

Responsibilities of Classroom Film Producers

By ALAN KELLOCK

In today's competitive world, with nations going all-out to strengthen their educational systems, the responsibilities of the classroom film producer take on a new and vital importance. He must choose subjects carefully to fit the curriculum, use competent subject-matter advisers, and create scripts that will provide genuine learning experiences. He must be sure of technical production quality, and if desirable and practical, he should pretest his product before final release.

EACH YEAR the major classroom film producers together release about 400 motion pictures. Approximately another 800 films released each year by industry, government and other organizations find some use in the classroom. The latest issue of Wilson's catalog of educational films lists over 17,000 titles, of which 6000 have been released in the last five years. This vast outpouring of films places great responsibilities upon producers to make sure that the value of the medium for education is not dissipated through sheer volume of product, and to maintain standards of quality that will ensure continuing growth of the audio-visual education industry.

Although this responsibility is, or should be, shared by all producers of all films that find their way into the classroom, it naturally falls most heavily on those relatively few producers who are in the business of making and merchandising films primarily for classroom use. Since we are interested here in only that type of film, it may be worth explaining in more detail what is generally meant by the term "classroom film."

What Is a Classroom Film?

The classroom film, as referred to in this discussion, has three distinct characteristics:

(1) The film is made for a specific educational audience, i.e., a class of students within a relatively small range of courses and grade levels.

(2) The subject matter of the film is tied directly into the curriculum and is therefore suitable for study by the class group.

(3) The film can be integrated in its use with the textbook and other related instructional materials.

Many films loosely referred to as "educational" are not true classroom films because they do not have all of the three characteristics just mentioned. Some commercially sponsored films which explain and demonstrate products or processes may have some educational value for certain special learning situations, but comparatively few such films are widely accepted for standard instructional situations in schools and colleges throughout the country. That is why a sponsored or so-called advertising film, even though offered on a free loan basis, may not be used in classrooms as extensively as its sponsors originally hoped or expected. It also explains why films originally planned for television, even though full of carefully documented information and made with excellent talent, may meet with but limited use when released later for educational distribution.

On the other hand, it is not correct to think of all classroom films as being fixed in format, or as lacking in variety as a set of billiard balls. As a matter of fact, there are at least four broad types of films that can be classified as classroom films within the scope of the characteristics outlined above. And while I personally dislike the formality of classification tables, and endorse the warning of Professor Edgar Dale, a leader in our visual education field, who once said: "Beware of hardening of the categories," nevertheless it would be helpful here to delineate the principal types of classroom films:

(1) *Informational.* The basic purpose is to convey factual knowledge, or to develop an understanding of one or more ideas, events, principles, processes or relationships.

(2) *How-To.* The basic purpose is to demonstrate and teach a skill in some physical activity such as in vocational training, home and family living, sports, the arts or military training.

(3) *Open-End.* The basic purpose is to stimulate constructive thinking and group discussion about some idea, concept or phenomenon on which the film invites the audience to supply some decision or conclusion not presented within the film itself.

Some classroom films are so constructed that they combine elements of two or all three of these types, but most of them fall principally in just one of those classifications. To these we must add a fourth type which we might label the "extended teaching film." This type, quite recent in development, involves putting an entire course, or a major part of it, on film and having the students spend a major part of their scheduled classroom time each week looking at sequential units of the film series. In some places where classroom films of this type are used, they are projected

Presented on October 21, 1958, at the Society's Convention at Detroit by Alan Kellock, Text-Film Department, McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36.
(This paper was received on October 9, 1958.)

on a screen in the classroom. In other schools, these films are being piped into the classroom by television. The teacher on the film becomes a substitute, at least in part, for the teacher in the local classroom.

How Classroom Films Begin

It is probably clear by now that a film comes to be a true classroom film only by being planned and developed from its inception. This kind of planning is of course a fundamental responsibility of the producer. He must make certain basic decisions right at the start of the project. What grade level or levels will the film be designed for? What area of the curriculum will it deal with? What will be the purpose of the film? Which of the four types of classroom films (described above) will it be? Skill and wisdom in making these initial decisions will have a great deal to do with the salability of the final product, so this is a time for informed opinion and mature judgment.

The producer may, and sometimes does, arbitrarily decide these questions on his own. It is more customary, and undoubtedly much wiser, to do some market research before casting the die. Any program of market research starts with the observations and opinions of people in your own organization. Valuable information is constantly flowing in from the field representatives and from the reports of people of the home office who are able to get out and attend teachers' meetings and conventions, to talk to people, find out what's needed, and what the market will buy. It is often a good idea to supplement these findings with other techniques of market research. Among these are personal interviews in depth, limited mailings of personalized letters to close friends and large mailings of carefully drafted survey questionnaires. We have used all these methods and have found them to be of value.

In many of our projects, we rely heavily on another source of help — the individual subject-matter adviser. He may be the author of a well-known textbook with which the film or films are to be correlated, or he may be some other prominent educator with special qualifications in the particular subject area and grade level that the film or films are concerned with. On some projects, particularly where a series of films is involved, more than one such educator may be engaged as adviser. The adviser not only helps in selecting topics for the films, but he also works closely with the script writer in the planning and development of script, and later with the director and editor after the footage is shot. In a few cases we have had the educational adviser present during the shooting too. His function is to help build maximum teaching value into the film, based on his knowledge of the subject matter as it relates to the overall curriculum, and on his knowledge of what teachers need to supplement their use of other teaching tools and techniques. The selection of educational advisers is a major responsibility of the classroom film producer.

A scene from *Children's Emotions*—a McGraw-Hill Text-Film.

The Creative Aspects

When the research is completed and the film topics are selected, the creative aspects of film production can begin. As with any other kind of film project, the producer of a classroom film has the responsibility of obtaining first-class talent to handle all the key jobs that make up the production team — script writer, director, cameraman, actors, lighting director, soundman and editor. However, the producer of the classroom film generally has a far smaller budget on which to operate than in any other kind of film production. The reason is that investment in a classroom film must be limited to what the producer can expect to get back through sales of the film to the educational film market, consisting largely of schools and colleges. The potential sale of the average classroom film is not yet large enough to permit anything beyond a modest budget for its production costs.

Some educational film producers exert direct control and supervision over all phases of the production, hiring their own talent and maintaining their own facilities. We prefer to contract the work out to commercial film producers, but we maintain close and continual liaison with these outside organizations through our own staff of project supervisors. We also make sure that a close working relationship with our subject-matter educational advisers is maintained at all times, as referred to previously.

Perhaps a brief word about classroom film production techniques will be of interest. If you were to spend a day screening films selected at random from the leading educational film catalog, you would find they ranged in format from a fairly simple kind of "illustrated lecture" with a soundtrack entirely of off-stage narration to the other extreme of what might be described as a Hollywood featurette, with all or a major part of the soundtrack consisting of location sound and lip-sync dialogue. Going back to our four types of teaching films, you would expect to find that most of the photography is shot silent for the two types of films classified as "informational" (designed mainly to convey factual knowledge) and as "how-to" (designed mainly to teach and demonstrate a particular skill). Special effects, such as animation, slow motion, photomicrography or stop-motion, may be included in these types of films. The explanatory voice is then added off-stage.

On the other hand, films designed to provoke discussion, stimulate constructive thinking and influence attitudes may often be more effective if they follow a dramatized format. For realistic and dramatic effects, direct dialogue is quite essential in these films, and the story lines contain some drama and pathos so that students can and will readily identify themselves with the characters in the film. To further this identity, we carefully set up specifications with respect to appearance, age, speech and activities of the characters in the film, and we make sure that backgrounds, props and other visual cues are typical of the average situation or location anywhere in the country, or at least in our major market areas.

Check Points for Quality

Whether the educational film producer handles the entire production directly, or whether he contracts it out, he is still responsible for the finished product that is released with his name on it. Consequently, he must ride herd on the job until it is in the can and turned over to the sales force. He must establish certain check points (such as script treatment outline, shooting script, work print, interlock, answer print and sample print) at which the material is carefully reviewed, often with the educational adviser, and given specific approval before further work is authorized. Often changes have to be made before the approval is granted.

As a means of making even more sure of the suitability of the final product, we have experimented with pretesting

the film before it is released for general sale and use. Pretesting must be done with typical samples of the specific audience for which the film was designed. We think at least two such audience groups should be used—in different schools or colleges, and in different geographic locations. Each film showing should be scheduled as close as possible to the time when the class will be taking up the topic treated in the film.

Following the showing, each student is given a mimeographed two-page quiz sheet to fill out. The front page has six to ten questions, the answers to which will indicate how well the student gets the message of the film. If the content is mostly factual, the questions may all be multiple choice. If, on the other hand, the film is the so-called "open-end" type designed to build an attitude, to raise questions in the student's mind and to get him to think constructively, the questions on the quiz sheet may require "yes" or "no" opinion answers followed by reasons by the student to justify or explain his answers.

On the reverse side of the quiz sheet, we ask other questions to determine the student's opinion of the film. For example, one question might read: "What were the things about this film that you particularly liked?" Another might ask: "Are there some things about this film you didn't like? If so, what were some of them?" And finally, we ask them to write any other comments they care to make.

Analysis of the answers to these questions usually indicates the strong and weak points of communication within the film. If a revealed weakness is considered serious, there are several possible remedies, any one of which, of course, will delay the release of the film and will increase the total production cost in varying degrees. The simplest remedial measure is to change the narration to make clearer explanations, build up or shift points of emphasis, improve transitions, etc. Another measure is re-editing, changing the order or length of scenes. If the pretesting results decisively indicate a weakness that can be remedied only by reshooting or additional shooting, we may do that too, though of course there must be reasonable expectation of recouping the extra investment in cost.

Thus far we have put 14 films through this kind of pretesting process. We still consider it an experimental procedure, and there are still many unanswered questions about its long-range values and just how it can be done most effectively. As a result of pretesting, changes were made in several of the 14 films which we believe improved them considerably. Whether those films would have sold as well without the changes, and whether the extra expense of making the changes was justified—these points are hard to prove. Decisions of this kind become part of the classroom producer's responsibilities.

Teachers' Manuals

Another responsibility of the classroom film producer is to prepare and make available teaching guides for his films. Teachers need help in preparing to use a film, and unfortunately they sometimes find it impossible to preview a film before it is shown in class. The teachers' guide, usually a two-page or four-page printed sheet, explains the purpose of the film, summarizes its content, provides questions for class discussion, suggests related class activities, lists reading references and (in some cases) presents a vocabulary of new words appearing in the film.

Two Final Responsibilities

This summary of the responsibilities of the classroom film producer would not be complete without mention of two more which are closely related. One of these responsibilities is to his own organization, to see that adequate return is earned on investment. Obviously, no commercial enterprise can long survive without a fair profit on the use of capital. To earn it in this business of limited customer budgets and vigorous selling competition, the producer must on the one hand constantly guard against extravagance in production planning, and on the other he must be sure that his material ties in directly with the prevailing curriculum trends and has sufficient quality to satisfy both teachers and students.

The other responsibility is to the entire nation. In these modern times, with nations going all-out to build up their educational programs as part of a possible struggle for survival, the classroom film takes on a new and vital importance as a teaching tool. We've come a long way in just fifty years since the first attempts to use the film medium for teaching. As we continue to improve film-making techniques and to find out more about the psychology and dynamics of the learning process itself, we classroom film producers have a never-ending responsibility to apply that knowledge to the improvement of our product. If we earnestly apply ourselves toward this objective, there is no doubt that we can look forward to steadily increasing appreciation by educators of the potential contribution that classroom films can make to the strength and effectiveness of our educational system in the United States.

Discussion

Reid H. Ray (Reid H. Ray Film Industries Inc.): At what stage do you pretest your films?

Mr. Kellock: It has been done at two stages. After approval of the interlock, we have magnetic-striped the film and transferred to the magnetic stripe both the location sound and a sort of "home-grown" version of the narration. In other words we haven't taken it through the regular professional studios with the finished narration. At other times, because the producer preferred it, the film for pretesting was carried through to the finished stage. There was an understanding with the producer that, if necessary after pretesting, he would open up the film and make necessary changes.

Mr. Ray: The method described first is certainly the most economical for this type of production.

R. S. Rekert: (National Film Board of Canada): Your considerable use of questionnaires is interesting. We attempt to do the same thing in Canada — asking what type of film they like, etc.; and we get various answers. One reply, particularly significant, was written in a feminine hand right across the whole face of the questionnaire: "Films? I dare not turn down the lights and shut the blinds in my classroom." All of which suggests the usefulness of sending out questionnaires. We find primarily that sales resistance stems from local prejudice. One could say "Avoid putting out subjects of a controversial nature," but in my opinion there is hardly anything with any meat in it that is not controversial in some locality. How do you make a film palatable to the 49 States you have here? We are up against the problem of local prejudice daily in Canada where we have nine provinces. What do you do to overcome it?

Mr. Kellock: I very much fear that the day will never come when we will entirely eliminate it; however, we do attempt to overcome it as much as possible by keeping our ear to the ground through the channels of communication afforded to us by our field representatives who are urged every week, and particularly in our semiannual sales meetings, to send in as much local information and local gossip, local attitudes, etc., as possible. We know that there are certain educational film users, for example, who will not buy a film on human reproduction, which is the subject of a film that we have been merchandising for a number of years. When it first came out almost eleven years ago, it was actually banned in certain parts of the country and this is the kind of prejudice — regional prejudice — that is very disconcerting to an educational film producer. I don't know exactly how you're going to overcome it because after all we have national problems of prejudice on the political front that are a long way from solution, and film producers are subject to the same regional differences. We can attempt to solve the problem in one of two ways; first we can make our material for those subject areas of greatest sales potential and ignore purely local tastes, opinions, or perhaps prejudices; and the other way is to compromise as much as we can without losing our main markets. At McGraw-Hill we follow both of these procedures.

S. Dworkin (Bell Telephone Laboratories): Do you ever put out films without a preliminary survey?

Mr. Kellock: There is no one answer to how best to crank up ideas for films — at least we haven't lived long enough to find any one method that is best in all cases, and probably never will. Yes, we have produced films and series of films on which we did no preproduction market research. We simply followed the equivalent of holding a wet finger in the wind and seeing which side was cooler, a rough rule of thumb (or finger) that I personally feel involves considerable risk. Our program has an advantage in that many of our educational classroom film projects are tied in with McGraw-Hill textbooks, so that we start with a blueprint, so to speak, of the material. We also start with the author or authors of the book who thereby become educational advisers to the project and we have an indication of the popularity of the subject matter as judged from the book's sales figures. So if we combine those factors, a case can be made in some instances for eliminating the market research before production starts.

An Experimental Evaluation of Sound Filmstrips vs. Classroom Lectures

By SOLOMON DWORKIN and ALAN HOLDEN

Four, 45-min sound filmstrips on atomic bonding, produced by the authors, were tested with 120 graduate engineering students. Half were taught by the regular lecture and half by the filmstrips. An examination and a questionnaire indicated that there was no significant difference in learning between the two groups. Most of the students were willing to accept the sound filmstrips as a teacher substitute.

THE THREE AIDS to teaching cited most often in discussions of present-day educational problems are television, motion pictures, and filmstrips. The sound filmstrip, discussed in this paper, has proven an invaluable teaching aid. It gained great prominence during World War II as an aid to classroom teaching but it has received little consideration as a possible substitute for live teaching.

What about the sound filmstrip? Since it is such a good audio-visual *aid*, why might it not be a good substitute for the classroom teacher? This was the question to which an answer was sought in the experiment conducted by the authors with graduate engineering students.

The sound filmstrip is a series of still pictures photographed onto 35mm motion-picture film. These pictures are projected one at a time with a soundtrack which is either on a phonograph record or on tape. A section of the soundtrack is synchronized with a picture by means of a signal which may be audible or supersonic. Usually the audible signal is a cue for the operator to turn to the next picture while the supersonic signal automatically activates the projector and turns the filmstrip to the next frame. This gross synchronization of a portion of the track with a picture is the only type of synchronization available. On the average, about three or four pictures are projected per minute, producing a rather static presentation in comparison with motion pictures and television. But the filmstrip has the advantage of being less costly to produce and distribute than either motion pictures or television. For example, color motion-picture prints cost about fifteen times as much as color sound filmstrips of the same running time.

The Experiment

The experiment was carried out in the belief that the sound filmstrip might prove to be *no less* effective than the classroom lecture. There was no assumption made that the sound filmstrip could be substituted for the entire teaching-learning situation, but only for the classroom lecture portion of the situation. The experiment consisted of producing four sound filmstrips on the subject of the bonding of atoms; dividing the students participating in the experiment into two equated groups; showing the sound filmstrips to one group while the other group was being taught by a live lecture; and then evaluating the differences in learning between the two groups by a written examination.

The experiment was conducted in 1957 at the Bell Telephone Laboratories. The facilities of the Communications Development Training Program (CDT), a Bell-run school conducted by the Bell company for all new graduate employees, were used. The junior author was teaching these students a course in the physics of solids, at the time, and these students were used in the experiment. There were 120 students in the class, most of them graduate electrical engineers with bachelor degrees.

Four lectures from the semester's twenty-four were chosen for the experiment. The subject, the bonding of atoms, was chosen principally because it afforded a reasonable balance between abstract material difficult to visualize, and material more easily visualized.

Each filmstrip contained about 150 frames and ran for about 50 minutes including two breaks of three minutes. The techniques used to produce the filmstrips were kept simple. There are indications in research[1] that more sophisticated techniques of production do not lead to significantly greater amounts of learning, and there were reasons for keeping costs down and for producing the filmstrips in a hurry.

An important aspect of the experiment is that the teacher who conducted the lecture section for one group also wrote and recorded the scripts for the filmstrips shown to the other group. Thus there was reasonable assurance that the contents of the two media were similar. Although research in the audio-visual field has included many experiments which compare one medium with another, the comparison is too often between contents quite different in detail. In this case the content and details were both made as similar as possible, but differences appropriate to the two media remained, in particular a much larger number of illustrations in the filmstrip than a lecturer could put on the blackboard in the same time.

Techniques of Production

The drawing techniques were basically those employed by draftsmen. Many of the drawings were simple black-and-white line drawings. In some cases gray tones were introduced by the use of Zip-a-tone or construction paper. Much of the lettering was standardized by using a mechanical lettering set. Examples of some of the drawings are shown in the illustrations (Figs. 1 and 2). The drawings were all $7\frac{1}{2}$ by 10 in., centered on a card 11 by 12 in. They were transferred onto 35mm motion-picture film by a commercial firm.

The tape recordings were made at $3\frac{3}{4}$ in./sec on an inexpensive tape recorder. The studio was an ordinary office. The signal tone was made by striking a tumbler with a teaspoon.

Evaluation

The matched-groups technique was used in comparing the filmstrips with the live lectures. The 120 students in the class were matched into two equated groups on the basis of college degree achieved, grades on two previous physics courses taken in the CDT Program, and recitation section assignment. One of each matched pair was randomly assigned to the filmstrip group, the other to the lecture group for the period of the four experimental lectures. The lecture group was taught during the same hour as the filmstrip group, in a different classroom. The showing of the filmstrips was without incident, although the conditions under which they were projected were not ideal — the acoustics in the room were poor, and considerable light leaked in from the windows, slightly degrading the picture.

A few days after the four lectures, before any more classes were held, the students were given a mid-term examination covering the entire half of the semester's work including the four experimental lectures. The questions relevant to the content of the four experimental lectures were not indicated as such on the examination. The students also answered a questionnaire which asked them how they liked the sound filmstrips. Absences and other factors caused the elimination of twenty-one pairs of students. It was the scores of the remaining thirty-nine pairs of students which were used in the final statistical analysis.

Analysis of the examination grades

Presented on October 21, 1958, at the Society's Convention in Detroit by Solomon Dworkin (who read the paper) and Alan Holden, Bell Telephone Laboratories, Murray Hill, N.J.
(This paper was first received on September 23, 1958, and in final form May 14, 1959.)

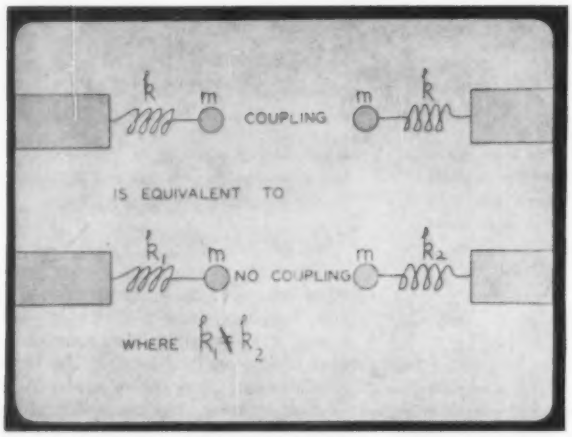


Fig. 1. Frame of filmstrip used in science course. Gray tones introduced by the use of Zip-a-tone.

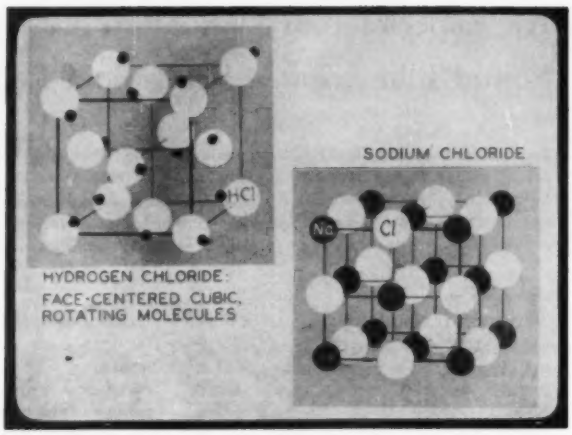


Fig. 2. Frame of filmstrip used in science course. Black, white, and gray construction paper is used for contrast.

was by means of the critical ratio technique,[2] and showed that there was no significant difference between the two methods of teaching. Critical ratios were also calculated for the nonexperimental portion of the mid-term examination and for the final examination of the course. The calculations indicated that the matching of the groups was adequate.

The answers to the questionnaire showed that the rate of delivery of material was too fast. A count of the actual spoken rate of narration yielded a figure of 135 words per minute. This is much higher than the rate of 100 words per minute for task films recommended by research,[3] and even quite a bit higher than the rate of 120 words per minute which is a common rule-of-thumb adopted by many film producers. The questionnaire also indicated that about 40% of the students regretted losing the opportunity to ask questions in class, although a few thought that this was an advantage. None of the students made any remarks about the drawings used in the filmstrips.

Of greatest significance was the finding that 75% of the students stated that they were willing to accept sound filmstrips of this type as substitutes for the live teacher-lecture. Some of them qualified this statement by insisting that the rate of delivery would have to be reduced.

Conclusion

In this experiment the filmstrips were under especially keen competition because their production gave the lecturer unusually good preparation for the later lectures. But it can readily be questioned whether the mid-term examination furnished an adequate test of the relative effectiveness of the two media. For example, it provided no test of how long the students would retain the material. It should also be remembered that the lectures, and their filmstrip counterparts, were not the only avenues to learning in the course; they were supplemented by recitation sections, and reading and problem assignments, which were the same for both groups.

Although the results obtained apply only to this particular experiment (with graduate engineering students), it seems possible to make some generalizations. If it is true, as this experiment indicates, that sound filmstrips can be used as effective substitutes for the live lecture in the classroom, then they might also be substituted for the motion-picture and television lecture. Furthermore, if all three of these media can be substituted for the live classroom lecture, it is possible that other methods such as reading assignments alone, can be used as effective substitutes and therefore in many cases the classroom lecture is superfluous.

And what about production techniques? This experiment reaffirms the findings of other experiments which indicate that sophistication of production techniques is not necessarily needed for effective learning. It again raises the question whether there is justification in spending considerably more money for color productions of a highly polished nature when black-and-white productions using simple techniques can accomplish the same job.

The success of the sound filmstrip in this limited experiment carries with it the implication that some combination of all three media — television, motion pictures and sound filmstrips — may be an economical, effective classroom lecturing method in the future.

References

1. *Instructional Film Research*, Pennsylvania State College Instructional Film Research Program, Tech. Report SDC 269-7-19.
2. Quinn McNemar, *Psychological Statistics*, Chapter 5, John Wiley and Sons, New York, 1949.
3. J. V. Zuckerman, *Commentary Variations: Level of Verbalization, Personal Reference, and Phase Relations in Instruction Films in Perceptual Motor Tasks*, Pennsylvania State College Instructional Film Research Program, Tech. Report SDC 269-7-4, 1949.
4. Solomon Dworkin, *The Production and Evaluation of Four Sound Filmstrips on the Subject of Atomic Bonding, Designed as a Substitute for the Live Classroom Lecture: A Case Study*, Doctoral Dissertation, Syracuse Univ., 1958.

Discussion

Alan Kellock (McGraw-Hill Text Films): Particularly interesting is the analysis of the objections by the students who took this course, especially the "pacing." Did they find that the pacing seemed to be faster or actually was faster than the classroom presentation which Mr. Holden himself carried on?

Mr. Dworkin: As a matter of fact it was faster. There was about 25% more material presented in the filmstrips than in the lectures. The teacher was not able to present the same amount of material in his lecture.

Mr. Kellock: If it were redesigned in filmstrip form so as to conform more closely with what the teacher presented in person would it have been better for filmstrip purposes?

Mr. Dworkin: Perhaps it would not have been better but I believe that if we were going to make these filmstrips over again we would pace them much slower, and in my opinion they would then be more effective.

Mr. Kellock: The other objection that you mentioned was that the students missed the opportunity to ask questions. Do you have any further thoughts as to how this objection might be overcome?

Mr. Dworkin: There were more students who missed the opportunity to ask questions than did not miss it. Incidentally, there were some students who thought this was great. They did not like the idea of questions being asked in class. I don't really think this latter is an important objection. Obviously there's one big loophole here — we don't know whether or not we could have dispensed with the teacher and the filmstrips entirely and still have achieved the same results. We couldn't divide the group into three sections for this purpose and this was a drawback. We assume that the teacher and the classroom lecture are necessary in this teaching process, as it is now designed.

Seymour Friedberg (Audio Visual Center, Indiana Univ.): Do I understand that 25% more material is presented in the filmstrips?

Mr. Dworkin: That is approximately correct.

Mr. Friedberg: I don't quite understand then why you don't make a point of this. You say

that there was no significant difference in the scores on the exams and yet the people who were subjected to the filmstrips got 25% more. It seems to me that is rather significant.

Mr. Dworkin: We realized, of course, that this is happening — a little too late. The examination was so structured that the people who attended the lectures would not suffer because they didn't get as much material.

Mr. Friedberg: If more material can be conveyed to the student by means of the filmstrip than by means of the lecture would this not make the presence of the teacher unnecessary?

Mr. Dworkin: This would depend on the teacher. In this particular case more material was presented in the filmstrips. The conclusion based on the students' opinion is that this is not desirable. There are indications in other experiments that you can get more material across by means of a filmstrip than with a lecture because it is a mechanical device. There is also another thing about the filmstrip I'd like to bring out here. It is a mechanical device — that thing just goes on and on and on, and if you stop to think or breathe at the wrong time you might be lost. This is one of the objections to these particular lectures.

Mr. Friedberg: I've been subjected to the same thing many a time by a live teacher who pumped information at you so fast that if you did stop to sneeze . . . .

Mr. Dworkin: Well then you might as well have the information on filmstrip.

Mr. Friedberg: That's the point I'm getting at. The students didn't like the medium, but nonetheless they were able to get 25% more material. Certainly, the point you made is a good one. The implications are very important for the use of the sound filmstrip.

Sol Roshal (Planning Research Corp.): I'd like to suggest that if the filmstrip is better than the teacher or equally as good, the teacher may be using the wrong method of presentation. We compare lectures with filmstrips and lectures with television but perhaps more emphasis should be placed on the proper use of lectures, television and filmstrips and other teaching methods.

Wm. L. Broecker, (WMSB-TV, Michigan State Univ.): Have you any test scores on long-term retention value of the information gotten from the film-strips, at 3, 6 or 12 months?

Mr. Dworkin: No. Due to the nature of the school and experimental population this would have been very difficult to obtain and also to derive any significance from the results.

An Experimental Film-Rental Plan to Aid Teacher Education

By ELLSWORTH C. DENT

The lack of conveniently available sources of supply of good educational films and of teacher experience in their utilization restricts the benefits to be derived from such teaching materials. Research has established what important contributions to classroom teaching can result from the proper use of suitable educational films. It is hoped that the data and experience derived from the experimental program described in this paper will help to bring about a much wider use of this valuable teaching tool.

ONE OF THE GREATEST deterrents to the more general and effective use of good educational films in schools is the lack of teacher experience in film utilization. It is estimated that approximately 20% of the teachers in the United States have had the benefit of training in the audio-visual field; furthermore, only a small percentage of the teachers in training will gain experience in using films to teach.

Another important factor which limits the more extensive use of teaching films is the lack of conveniently available sources of supply. This is common among schools of many types and is especially regrettable among the institutions which are responsible for the education of teachers.

Some of the colleges and universities which devote major attention to teacher education have film-rental libraries to serve the elementary and secondary schools in their areas of influence. These same films are usually available for use on the campus, and such use is encouraged in several instances.

A few of these institutions have films which have been acquired for permanent use in the laboratory school and in teacher-education courses. Others do not own films, but obtain them occasionally from rental libraries. A major problem is communication between the film sources and those who should be interested in the films.

There are numerous variations and combinations of these programs, but the majority of the institutions responsible for preservice education of teachers either have an inadequate educational film program or no film program at all. This means that most of the graduates who enter the teaching field will have little or no experience with the excellent possibilities for educational films when used properly.

It has been established through research that good educational films can make important contributions to classroom teaching. Charles F. Hoban, James D. Finn and Edgar Dale* have found that audio-visual materials, when used properly in the teaching situation, can accomplish the following:

(1) They supply a concrete basis for conceptual thinking and hence reduce meaningless word-responses of students.

(2) They have a high degree of interest for students.

(3) They make learning more permanent.

(4) They offer a reality of experience which stimulates self-activity on the part of pupils.

(5) They develop a continuity of thought; this is especially true of motion pictures.

(6) They contribute to growth of meaning and hence to vocabulary development.

(7) They provide experiences not easily obtained through other materials and contribute to the efficiency, depth and variety of learning.

It is axiomatic that skills in any procedure are developed through practice. Accordingly, it is highly desirable to have good films readily available for use as desired — especially by those in teacher-education courses who will be practicing professionally as soon as they have completed pre-service requirements.

In consideration of the accelerated need for scientific training and to extend educational opportunity into many other areas, Coronet Instructional Films has assembled a package of 50 films for teacher education. These have been offered to members of the American Association of Colleges for Teacher Education under a cooperative plan to: (1) supply certain films for use as needed, and (2) provide research information which will assist in planning future Coronet productions.

The first three films in the package of 50 trace the history of education in the United States. These films were designed to help tell the story of one of the most important influences on our American heritage. The fourth film, *Audio-Visual Ma-*

Presented on October 21, 1958, at the Society's Convention at Detroit by Ellsworth C. Dent, Coronet Instructional Films, 65 E. So. Water St., Chicago 1.
(This paper received in revised form May 8, 1959.)

*"Audio-Visual Materials," *Encyclopedia of Educational Research*, rev. ed., The Macmillan Co., New York (1950).

Fig. 1. A Puritan reading and writing school of the seventeenth century. (From the Coronet film, *Education in America: The 17th and 18 Century.*)

Fig. 2. 16mm sound projector in use in a classroom.

terials in Teaching, presents an overview of various types of useful audio-visual materials, and includes good utilization techniques.

The remainder of the package is comprised of 8 subjects containing teacher-student relationships in counseling situations; 23 films which include classroom situations for method analysis; and 15 effective films for various subject areas, ranging from lower elementary through high school.

The films supplied under this plan are not limited to use on the campus of the cooperating institution. If the practice-teaching program is conducted off the campus, teachers in training may use the films there. Five teachers' guides are furnished for each film to assist instructors and trainees in the planning of their utilization programs.

The cooperating institution agrees to assign to a qualified member of its staff the responsibility for keeping these films in good condition; announcing their availability to all instructors and future teachers in preservice courses; handling film requests; encouraging the use of the films as often as desired; and relaying to Coronet Instructional Films the reports of those who use the films.

These reports are simple ones, indicating the reactions of those who see the films — instructors and trainees. All are reviewed by the research division of Coronet for consideration in the planning of future productions.

Black-and-white prints of each of the 50 films and the accessory materials are deposited with each cooperating institution for a period of 12 months at a total cost of $250.00. The films alone have a value of approximately $3,100 at current prices, so the nominal rental fee is much less than the costs involved. At the end of the year, the films may be returned at no further obligation, or they may be retained another year by paying another rental fee.

As indicated above, this is an experimental program. It will be reviewed before the end of the current academic year to determine its effectiveness. If the program seems a desirable one for everyone concerned, it may be either revised or expanded to meet the requirements of participating institutions. In the meantime, all who have ordered the films have been assured the privilege of retaining those films another year on the same rental basis.

The response to the announcement of this program was immediate and gratifying. Acceptances came from colleges of various sizes, from schools of education in universities across the continent, and from the University of Puerto Rico. There are 45 cooperating institutions, including 5 on the Pacific Coast, 9 in the northeastern states, 25 in the north central states, and one each in Montana, Nebraska, Alabama, South Carolina and Florida.

It is interesting to note that such institutions as Indiana University, Syracuse University and the universities of Florida, Michigan, Missouri and Wisconsin — which already have most of these films in their rental libraries — have also ordered this program. This will permit the films in the experimental package to be made available for use as needed in the laboratory school or in the school of education. Several of the other institutions own very few films or none at all. In those instances, the films will provide excellent experience in utilization, and may develop an appreciation of the values to be derived from films which are readily accessible.

The institutions which are now cooperating in this experimental program offer a wide enough range to provide adequate data for later consideration. For this reason, additional institutions will not be encouraged to join in this cooperative experiment until the beginning of the summer sessions in June 1959. In the meantime, all available data and experience will be used to determine the future direction and expansion of a program to break the teacher-education bottleneck in film utilization.

Scope and Nature of Nontheatrical Films in the United States

By JOHN FLORY
and THOMAS W. HOPE

The audio-visual technique of communication is today one of the fastest growing segments of the motion-picture industry. The current annual nontheatrical-film investment is more than a quarter-billion dollars. Dividing the industry into six principal fields, the paper presents such factors as expenditures; number of productions and types of production units; projector ownership; styles and types of films; and distribution of films and size of audiences. The largest of the six categories considered — business and industry — including both large and small companies, applies a variety of visual-communication tools to advertising and sales, industrial and public relations, and research and development. Although limited as yet, the circulation of business films abroad is steadily increasing.

Of the four major areas of the motion-picture industry, that of nontheatrical films has shown some of the greatest growth in recent years. Furthermore, because there has been some confusion about the terms, "educational films," "documentary films" and "nontheatrical films," it may be helpful to define the nature and scope of nontheatrical motion pictures.

The use of motion-picture films is divided into four major areas: theatrical, nontheatrical, television and amateur cine.

Nontheatrical Films (synonymous with the Audio-Visual Field) represent an investment of over $2\frac{1}{2}$ billion in the United States since World War II. Current annual dollar volume is in excess of a quarter-billion dollars.

For example, in 1958 the dollar volume remained about even with that of 1957, off only $2 million despite the Recession (Table I). (The factors used in determining the totals are motion-picture and filmstrip production, release prints, distribution costs, equipment purchases — primarily 16mm sound projectors—and other audio-visual materials and equipment including filmstrip projectors, 2 by 2-in. slides and projectors, used professionally (not by amateurs), overhead transparencies and projectors, opaque projectors, etc. Tape recorders and record players are not included.)

Of the six categories given in Table I, the last two deserve some explanation. "Civic, Social Welfare, etc.," includes recreational, fraternal, service, youth and similar organizations, public libraries, 16mm entertainment applications (such as for shut-ins) and miscellaneous. Most expenditures of the Medicine and Health category could be allocated to Business and Industry and to Government in addition to Education and some community groups. On the other hand, Medicine is large enough to list as a separate category. This is not yet true in the case of Farming and Agriculture, where most budgets originate from either business or governmental sources, but where the total is comparatively small.

Table I. Comparative Annual Investment by the American Public in Nontheatrical Film and Audio-Visual Field, 1957 and 1958 (in millions).

Category	1958	1957
Business and Industry	$150	$156.0
Government (Federal, State, Local)	48	49.0
Education	27	25.0
Religion	15	13.9
Civic, Social Welfare, etc.	8	7.51
Medicine and Health	7	5.7
Totals	$255	$257.11

Because of the Recession, business sponsors curtailed their film programs, with the result that total expenditures in 1958 dropped from $156 million[1] to $150 million (Table II). The principal decline was in release prints, off from $32 to $28 million, a drop of $12\frac{1}{2}\%$. Production weakened a trifle, from $66 to $65 million, and expenditures for other audio-visuals declined from $23 million to an estimated $21 million. Equipment purchases held the same at $12 million, while distribution budgets increased from $23 to $24 million.

Government expenditures in the nontheatrical field were off only $1 million, from $49 to $48 million.

As a result of the increased emphasis on education — resulting from Sputnik — the educational film business experienced an 8% increase, from $25 million[2] to $27 million.

For the total audio-visual field, motion-picture and film-strip production represents the largest factor, or 37% of the money expended. Altogether, film production, release prints and print distribution represent 71% of the total (Fig. 1).

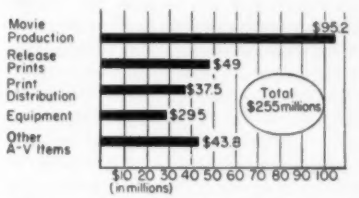


Fig. 1. Estimated audio-visual expenditures in the United States in 1958.

Nontheatrical Productions

Numerically, the number of nontheatrical motion pictures turned out in 1958 did not differ materially from 1957's total except in the Education category, which increased from 300 to 500 titles (Table III). The 7300 does not

Table III. U.S. Nontheatrical Film Productions for 1958 (est.).

Business and Industry	4500
Government (Federal, State, Local)	1500
Education	500
Medicine and Health	300
Religion	200
Civic, Social Welfare, etc.	200
Experimental and Avant Garde	100
Totals	7300

Table II. Estimated 1958 Expenditure Factors by Categories (in millions).

	Prod.	Prints	Dist.	Equip.	Other audio-visual	Total
Business and Industry	$65.0	$28.0	$24.0	$12.0	$21.0	$150.0
Government (Federal, State, Local)	18.0	8.0	5.0	4.0	13.0	48.0
Education	4.5	6.5	2.5	7.5	6.0	27.0
Religion	3.6	3.7	2.0	3.5	2.2	15.0
Civic, Social Welfare, etc.	1.3	1.3	2.75	1.7	0.95	8.0
Medicine and Health	2.8	1.5	1.25	0.8	0.65	7.0
Totals	$95.2	$49.0	$37.5	$29.5	$43.8	$255.0

A contribution submitted on April 1, 1959, by John Flory, Advisor on Nontheatrical Films, and Thomas W. Hope, Assistant Advisor, Eastman Kodak Co., 343 State St., Rochester 4, N. Y. This paper is expanded from material presented on October 21, 1958, at the Society's Convention at Detroit, by the authors under the title, "Analysis of Growing Business Film Usage."

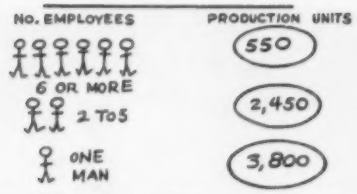


Fig. 2. Nontheatrical film producers in the United States.

include several thousands of low-cost silent and magnetic-tracked films produced during the year for internal use by industry with only one or two release prints each. Neither does it include certain classified government films.

Producers of Nontheatrical Films

Just who produces America's nontheatrical films? Broadly speaking, 6800 different production units (Fig. 2). Of these, 550 have six or more permanent employees, with the average top business film producer having a full-time staff of between a dozen to two dozen. This is the group of production units which turns out most of the more ambitious films. In a second group of producing units — approximately 2450 in number — each has from two to five permanent employees on its staff. And, finally, it is estimated that there are about 3800 one-man production units in the country.

These production units are of two basic types, "Commercial" and "In-Plant." While there are several scores of In-Plant units large enough to rank in the top 550, most of the larger producers are independent, commercial producers.

The so-called In-Plant units tend to be smaller in size. And, as a matter of fact, most of the 3800 single-employee units are made up of individual cameraman-producers working on the staff of some business firm or other organization.

Persons Employed

The postwar surge in audio-visual activity has seen the full-time employment rise to an estimated 1958 total of 47,950 persons (Fig. 3). Of this number, approximately 16,650 are engaged in film and other audio-visual production work.

Of the 5400 employees working in the nation's film processing laboratories, probably two-thirds are engaged in handling theatrical, television and amateur cine footage. This means that about 1800 persons can be allocated statistically to nontheatrical films.

The distribution of 16mm film accounts for a surprising total of an estimated 19,000 jobs. Unlike the entertainment film industry's system of a limited number of key-city exchanges, nontheatrical films reach their audiences through a vast network of over 3660 film libraries.[3] (How nontheatrical films are distributed is discussed later in this paper.)

Conservative estimates indicate that at least 4500 individuals function as professional audio-visual directors and communicators. This would include school-system and college audio-visual directors, industrial film communication specialists, government film officers and audio-visual and film specialists in religion, medicine and many other fields.

This total does not attempt to include the numerous part-time audio-visual coordinators (found in individual schools, plants, hospitals and other institutions) who spend a small but definite portion of their time handling audio-visual matters. This group alone has been estimated at from 25,000 to 100,000 persons.

It is hard to ascertain on more than a rough basis the total number of workers employed in the manufacturing, servicing and selling of film and audio-visual equipment. An educated guess would be in the neighborhood of 6000.

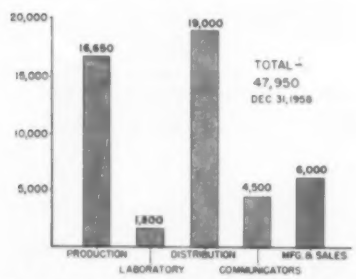


Fig. 3. Persons employed in the audio-visual field.

16mm Projectors

Sales of 16mm sound motion-picture projectors manufactured in the United States increased 3½% in 1958 over the previous year. This represented a unit total of 45,000,[4] of which 6200 went into the export trade. Adding secondhand machines now in use, the total number of operative machines in the United States as of January 1, 1959, is an estimated 596,500 (Fig. 4).

This makes a ratio of one machine for every 305 persons in the United States. The significance of this figure is that it indicates an increase in the potential audience for nontheatrical films.

Ownership of these projectors by the various segments of the nontheatrical motion-picture field approximates the pattern shown in Fig. 5.

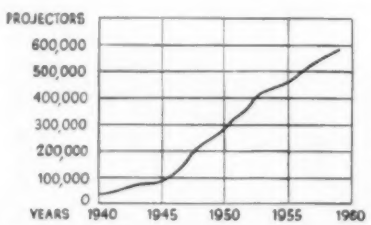


Fig. 4. Estimated number of 16mm sound projectors in use in the United States as of January 1, 1959.

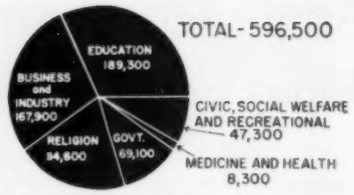


Fig. 5. Ownership of the 596,500 16mm sound projectors in use in the United States as of January 1, 1959.

Today, via the medium of the 16mm motion picture, it is theoretically possible to reach more than one half of the population of the United States.

Film Uses vs. Types

Styles and types of motion pictures are often confused with the purposes for which the films are used within the nontheatrical field. In this sense, two of the most misused terms are "documentary" and "educational." As defined in this paper, documentary is a type or style of film production, whereas educational refers to the purpose for which a film is made.

Here is a check list of styles and types:

- Documentary
- Newsreel
- Story plot
- Travelogue
- Animation — cartoon
- Stop motion
- Filmograph
- Live action
- Voice-over
- Lip sync
- Foreign-language versions
- Camera-talk
- Nuts-and-bolts
- Trip-through-the-factory
- Open-end
- Film-loops
- High speed
- Time-lapse
- Microscopy
- Cinefluoroscopy

Medicine and Health

The use of motion pictures and slides in the specialized category of medicine and health continues to accelerate. An estimated $7 million is being spent annually, while the number of motion-picture projectors used is close to 8300 (6300 in hospitals and 2000 others).

Budgets for medical films are primarily supplied by pharmaceutical firms, government agencies, foundations and universities. In addition, many low-cost single-print productions are turned out by individual medical men.

Civic, Social Welfare, Recreational, etc.

This heterogeneous category of many organizations probably represents the ownership of 47,300 projectors. Its total annual expenditure has increased to $8 million.

Many of the groups within this category have active film programs on the national level. At the community level,

the individual groups make enthusiastic use of films in their regular meetings. Outside of the classroom, these are the groups which comprise in excess of 1,000,000 potential audiences of 50 or more members each. See Fig. 6 for an indication of the pattern by which individuals tend to affiliate themselves with groups that are potential 16mm film audiences.

Religion

With more than $2 billion in new church construction either in progress or contemplated during the next five years, audio-visual usage in this category is expected to accelerate proportionately. In 1958, churches and synagogues owned an estimated 114,600 projectors. Increased film programs brought the year's audio-visual dollar volume up to $15 million.

A year-by-year analysis of 2206 religious film productions is shown in Table IV.

Table IV. Religious Film Productions by Years.

Year	Productions per year	Year	Productions per year
1915	1	1942	14
1922	1	1943	9
1925	2	1944	20
1928	1	1945	24
1929	1	1946	31
1930	4	1947	80
1931	2	1948	129
1932	6	1949	113
1933	1	1950	135
1934	3	1951	151
1935	9	1952	187
1936	3	1953	200
1937	7	1954	178
1938	14	1955	170
1939	28	1956	202*
1940	18	1957	210*
1941	25	1958	227*
Total			2206

* Estimated

Audio-visuals are used in churches and synagogues chiefly for:

- Religious Education (church weekday and Sunday schools)
- Adult Groups
  - Stewardship
  - Missions
  - The Bible
- Youth Groups
- Family Events and Festivals

Education

Expenditures in the Education category are expected to increase materially over the $27 million total of 1958, as given in Table II. This acceleration is the direct result of the passage by Congress of the National Defense Education Act of 1958, hailed by some educators as the most far-reaching piece of school

Fig. 6. Pattern of audience affiliation for 16mm movies.

legislation since the original Land Grant Act of 1862.

Education continues to be the category possessing the largest amount of audio-visual equipment. As of January 1, 1959, the number of 16mm sound motion-picture projectors was estimated at 189,300 (Table V).

Table V. Educational Projector Ownership.

	Projectors	No. schools
Public elementary schools	104,300	110,875
Public secondary schools	56,000	25,627
Colleges and universities	15,000	1,863
Parochial and private elementary and secondary schools	14,000	15,652
Totals	189,300	154,017

Educational motion-picture production during 1958 totaled approximately 500 titles. The recent trend of filming an entire course of study has continued. One series alone consisted of approximately 160 half-hour productions.

Altogether, the cumulative total through the years reached 7900 titles as of January 1, 1959. An analysis of the most commonly used educational film directories indicates that commercial producers have accounted for 4770. Most of the remaining 3130 titles were the output of the on-campus film-producing units of over 80 colleges and universities.

For elementary and secondary schools, audio-visuals have these principal purposes: Classroom instruction, auditorium instruction, club and extracurricular meetings, adult meetings (staff, PTA, etc.) and public relations.

Government

Federal, state and local audio-visual expenditures, totaling $48 million for 1958, were off 2% from the previous year as a result of budget tightening during the first three months. At the end of 1958, 16mm projectors in use by all government agencies totaled 69,100.

State governments are making use of

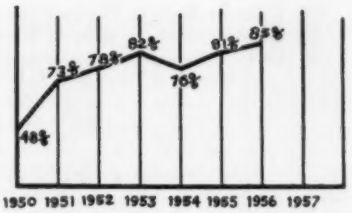


Fig. 7. Rise in film use for communication among 100 large companies.

motion pictures for an increased number of purposes: Conservation, tourism, traffic safety, crime prevention, industrial expansion and others.

Business and Industry

The largest single category of the nontheatrical film field — representing three-fifths of the dollar volume — is Business and Industry, which accounted in 1958 for a total of $150 million. This was a $6 million drop from the previous year, directly attributed to the Recession.

Reports indicate that the total number of new productions turned out during the year held up. Many release print orders, however, were cut back substantially. As business conditions improved, this trend was reversed sharply.

A survey[b] of 100 large U.S. corporations shows that during a six-year period, business film usage increased from 48 to 85% (Fig. 7).

An entirely different study, made by the National Industrial Advertising Association of 341 manufacturing firms, also revealed substantial business film usage:

86% use slides and filmstrips,
79% use motion pictures,
74% use flip charts, and
41% use sound filmstrips

Application of the Visual-Communication Concept to Business. Today, use of visuals in the field of business is no longer restricted to motion pictures alone. Faced with the problem of communicating — both within and without organizations — with a variety of individuals and groups, management is using a wide assortment of audio-visual techniques. Just as the golfer has a bag of clubs to choose from for any particular shot, so an executive can select an appropriate visual tool from among many types to solve his special need. One business visual communications executive uses over 60 different audio-visual devices.[1]

Ranging from motion pictures of professional caliber through sound slidefilms, filmstrips, low-cost, internally made movies and overhead transparencies to 2 by 2-in. Kodachrome slides, business has embraced the concept that these tools are an integral part of the communication process in every facet of a company's operations.

Film Usage by Business. The pattern by which business tends to allocate funds for motion pictures varies from sponsor to sponsor, depending upon size, type of industry and several other variables. By and large, departmental film budgets rank in this order: (1) sales, (2) advertising, (3) public relations, (4) research and development and (5) industrial relations.

Today, business and industry use films for:

Sales:
- Selling and sales promotion
- Sales training
  - Company personnel
  - Dealer and/or jobber personnel

Advertising:
- Advertising (product or service shown in action)
- Corporate image (promotion of the company itself — sometimes a public relations function)

Public Relations:
- Sponsored education (sometimes an advertising function)
- Public service
- Group relations (stockholders, community, etc.)

Research and Development:
- Analytical (high speed, time lapse, etc.)
- Instrumentation
- Reporting
- Other uses

Industrial Relations:
- Employee and labor relations
- Supervisory training
- Safety
- Job training
- Work simplification (time and motion studies)

Film Budgets of Large Businesses. An analysis of what representative large sponsors spend for audio-visual programs indicates that although this totals anywhere from one hundred thousand dollars annually to several million, the ratio of visual-communication expenditures to a sponsor's gross sales tends to be less than 1% — from 0.34 down to 0.03 of one per cent. Those smaller companies with good visual programs (Table VI) have a higher audio-visual to dollar-sales ratio than do large corporations.

Low-Cost Visuals for Business Use. Although it originally took a relatively large company to derive, as a sponsor, maximum benefit from the use of business motion pictures, today profitable use of the medium can be enjoyed by firms of nearly any size.

Businesses, both big and little, are making effective use of "ready-made" films produced by someone else. These include the syndicated films intended for sale and/or rent, as well as those turned out by other business sponsors and made available generally. Today, the profitable use of low-cost visuals is not limited to large corporations. Slides, overhead transparencies, movies, etc., can either be prepared by the company's own personnel, or be jobbed out to local commercial sources.

Table VI. Audio-Visual Expenditures* of Selected Successful Sponsors.

	Audio-visual cost	% of Sales, in fraction of 1%
Airline	$1,050,000	0.0034
Electronic	375,000	0.0014
Metal	1,000,000	0.0012
Automobile A	6,000,000	0.0011
Automobile B	8,275,000	0.0008
Oil and mining equipment	200,000	0.0007
Petroleum	5,000,000	0.0006
Utility	4,000,000	0.0006
Food processor	175,000	0.0003

* These audio-visual figures represent expenditures for *all* audio-visuals used internally and externally, i.e., motion-picture and filmstrip productions, release prints, distribution, 16mm equipment and all other audio-visual material and equipment.

The 16mm magnetic-optical sound motion-picture projector, the advent of faster film emulsions obviating the need for heavy or elaborate lighting equipment, and the ready availability of good, inexpensive 16mm camera equipment have brought low-cost movies of an informal type within the reach of any business wishing to improve its visual communications.

It is now estimated that there are approximately 30,000 to 35,000 of these magnetic projectors in use. These machines are proving particularly helpful outside the United States where there are language barriers to be overcome at minimal cost.

Universities and schools, medical groups, religious institutions and other organizations faced with visual communication problems have adopted a wide variety of audio-visual tools. There is hardly a person in any business or profession who has not recently been in a meeting at which *some* sort of visuals were used.

How Nontheatrical Films Are Distributed

The distribution pattern for nontheatrical films is entirely different from that of the entertainment film industry. Instead of 458 exchanges in 39 distribution areas, nontheatrical films reach their several million "exhibitors" through an estimated 5000 16mm film libraries. The U.S. Office of Education currently lists 3660 film libraries distributing from one to several thousand titles.[3] The difference between these two figures is accounted for by the fact that of 3000 business firms circulating films probably 1340 firms which distribute their own films are not publicly listed.

Table VII. Free (Sponsored) vs. Rental and Sale Films Released During 1958 (est.)*

	Free	Rental
Business sponsored	4500	—
Government	1500	—
Education	—	500
Religion	—	200
Medicine and health	150	150
Civic, social welfare, etc.	100	100
Experimental and others	—	100
Totals	6250	1050

* The rule-of-thumb classification into two columns does not attempt to take into account the occasional exceptions within each category.

Borrowers of these 16mm films tend to classify them into two categories: free films, and rental and sale films.

Free (sponsored) films outnumber those which are sold and rented by six to one (Table VII).

Rental and Sale Films. The majority of films in education and religion are rental or sale items. The producer or sponsor putting up the capital for their production attempts to regain it — plus a profit — through the sale, lease or rental of release prints. The prints are usually sold to commercial film libraries or to noncommercial libraries, some of which restrict these films to their own organizations, while others generally make them available to the public. The types of noncommercial film libraries, according to whether circulation is restricted or general, are:

Restricted circulation:
- City schools
- County schools
- Cooperatives
- State education departments
- University on-campus units

General circulation:
- Universities
- Public libraries
- Government agencies
- Trade associations
- Social service agencies
- Religious agencies

The libraries may or may not elect to charge a rental or service fee from the film borrower. Some business firms do rent, lease or sell prints in an effort to recoup production and/or distribution costs.

Free (Sponsored) Films. Most of the films turned out in the categories of Business and Government are what the public thinks of as free films. These motion pictures are sponsored. Here the sponsor pays for the production, as well as the expense of release prints and their distribution.

Free films are circulated through one or a combination of the following: (a) sponsor's own organization, (b) commercial 16mm distributor and (c) noncommercial film libraries.

Depending upon his objectives, a sponsor can reach his audience via any one or a combination of four distribution channels (Fig. 8):

1. Lending prints to audiences self-equipped with 16mm sound projectors.
2. Lending prints to television stations for sustaining broadcasts (here sponsor does not pay for air time).
3. Using itinerant roadshowmen to reach rural and small-town audiences, or supplying operators and projectors to nonequipped audiences.
4. Showing prints in theaters.

Size of the 16mm Audience

Today, the total audience reached by a well-designed and aggressively circulated, sponsored film frequently compares in size with that of a successful entertainment-type feature picture. Naturally, such a large audience potential is stimulating alert advertisers to use the sponsored film medium. Here, motion-picture attendance represents actual viewership (comparable to readership rather than to circulation figures).

Of course, the unique nature of the sponsored-film medium permits the selection of specific target audiences with little waste circulation. As a matter of fact, some sponsors find it far more profitable to produce a movie for limited but highly specialized groups. There are cases on record where a $50,000 picture has been advantageously produced for an audience of only 200 persons. Here the *quality* of the audience far overshadowed quantity.

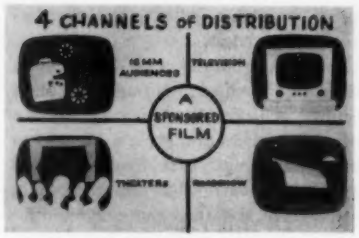


Fig. 8. Channels of distribution of sponsored films.

Normally, however, a successful business film intended for the general public may be shown to an audience of from several hundred thousand to several million each year. The annual audiences depend upon such factors as subject

SUMMARY OF THE FINDINGS

General	Sound film vs. silent film	99.4% are released in sound
	Color vs. black & white—productions	78% are produced in color
	16mm vs. 35mm—release prints	95% are 16mm prints
	Color vs. black & white—release prints	72% in color; 28% in B & W
	Length in running time	26 minutes (median)
	Life-span of films	16.5% over 5 years old
	(Most films still in circulation)	58% over 2 years old
	Total over-all cost	$87,264 (average)
	Relationship of major cost factors	Production 55.3% Prints 26.3% Distribution 18.4%
Production	Total production cost of 116 films	$4,514,477
	Production costs	$1,732 low to a high of $426,600 $25,800 (median)
	Cost-per-minute	$57.77 up to $5,925 $1,167 (median)
Prints	Total cost of release prints	$2,088,891 for 18,580 prints
	Number prints per production	100 prints (median)
	Average cost-per-print	From $19.54 up to $375.63 $122.74 (median)
Audiences	Major target audiences	Schools and colleges 89% Clubs, etc. 81% Business and industry 79% Company employees 62% Churches and Synagogues 61% Company management 56%
Number of Viewers	Annual viewers per film (excluding TV)	From 1,250 up to a high of 4,548,000 276,036 (median)
	Total viewers per film (excluding TV)	From 40,040 to a high of 21,852,465 1,268,851 (median)
	Total viewers per film including TV (covers only 9 productions)	1,095,635 to a high of 10,975,000 3,464,873 (median)
Distributors	Types of distributors	Sponsor only 43% of films Commercial 37% of films Non-commercial 36% of films
Total Production, Print & Distribution Costs	Average cost-per-viewer (under 1 year in circulation)	$.9735
	(1 to 2 years in circulation)	$.0681
	(2 to 5 years in circulation)	$.0832
	(5 to 10 years in circulation)	$.0364
	(over 10 years in circulation)	$.00469
	Average cost-per-viewer (over-all)	$.0463 for 86.6 million viewers
	Lowest cost-per-viewer for one film	$.00356 for 21 million viewers

Fig. 9. Significant findings from survey of public relations and advertising films.[7]

matter, production quality and distribution aggressiveness.

Looked at from the point of view of an advertising medium, the business motion picture achieves its greatest success when the distribution cycle is allowed to run a number of years. Excluding paid television and theater-screen circulation, sponsored films are not generally used for quick saturation campaigns, with some exceptions.

A typical example of a film in active circulation after ten years is American Telephone & Telegraph Company's *Adventure in Telezonia*. The film was constructed to key in with the curricula of the fourth and fifth grades in elementary schools. Careful preproduction planning, using educational consultants, assured subject matter acceptability. The ten-year box score shows 5076 half-hour color prints now in circulation and an audience thus far in excess of 15,000,000.

Another A.T.&T. film, slanted at adult as well as school audiences, is *Mr. Bell*, which has played to an aggregate audience of 35,000,000 in ten years and is still in active distribution with 586 prints.

The National Live Stock and Meat Board's *Meat and Romance*[6] has been played to over 50,000,000 persons in fifteen years through nontheatrical circulation, not counting any television audiences. *Green Harvest*, a Weyerhaeuser Forest Products film, has been seen by 13,481,229 in eleven years plus an estimated 54,000,000 via TV sustaining showings.

A popular film, Ford Motor's *American Cowboy*, has been seen by 12,000,000 to date. *How To Catch A Cold*,[6] produced for Kimberly-Clark, manufacturers of Kleenex tissues, has been seen by an estimated 170,000,000 persons via both nontheatrical and television channels in just seven years. Procter and Gamble's *Scrub Game*[6] in thirteen years has had over 200,000 showings with a total nontheatrical audience of over 13,000,000.

An extensive study[7] of advertising and public relations films has revealed the remarkable flexibility and proved economy of the medium (Fig. 9).

International Scene

In contrast to the Hollywood entertainment segment of the motion-picture industry, which derives more than half its support from the export market, U.S. nontheatrical films are predominately domestic. The limited number of 16mm projectors abroad and language barriers are the two principal factors slowing up expansion.

Although U.S. educational film producers do sell prints of their pictures overseas, the market is still relatively limited. American classroom films are oriented toward the curriculum in U.S. schools; therefore many of them are unsuited to foreign needs. Likewise, at present there is very little market for religious films abroad.

In the case of U.S. Government films, the U.S. Information Agency and the International Cooperation Administration have active programs in many areas of the world. Here, projection facilities have been made available through these agencies, and foreign-language versions are made when appropriate.

Circulation of American business films abroad has steadily increased since World War II. As the United States becomes more and more committed to a world viewpoint, this trend will accelerate. Stimulated by the original Marshall Plan of foreign aid, more than 800 American nontheatrical films — chiefly business-sponsored — were remade into different language versions, primarily in Europe. Most of these pictures were related to factory productivity and to sales.

Today, the European Productivity Agency, independent of U.S. support, is carrying on with an aggressive audio-visual program in which the magnetic-optical sound projector is facilitating the international exchange of business films by helping to surmount language barriers.

CINE (*Committee on International Nontheatrical Events*). In keeping with the growing recognition which American nontheatrical films are receiving as unofficial ambassadors abroad, producers and sponsors alike are showing greater interest in international film festivals. The selection and coordination of U.S. nontheatrical film entries for a number of these festivals is being handled by CINE.

Three Keys to Growth

Since World War II, the nontheatrical film and audio-visual field has expanded rapidly. Today it is one of the fastest growing segments of the entire motion-picture industry.

Future growth will, to a large extent, depend upon three key factors:

Tools: New equipment must be greatly improved for economy, simplicity of operation and portability—with daring use of new scientific developments.

Materials: The customers want improved products at lower costs, and a wholly new pattern of mass film distribution is called for.

People: High-caliber young people must be attracted to the field; more efficient training in production, distribution and utilization is needed.

Effective communication is the nerve system of present-day society. With the growth in population, the greater complexity of everyday living, and the battle against rising costs, nontheatrical films and other audio-visual materials — if they can be applied to the problem with energy and imagination — hold promise of bringing many benefits to interpersonal communication.

References

1. John Flory, "The economic impact of the audio-visual field," *Jour. SMPTE, 66:* 458–461, Aug. 1957.
2. Thomas W. Hope, in Progress Committee Report for 1957, "Educational Motion Pictures and Television," *Jour. SMPTE, 67:* 339, May 1958.
3. U.S. Office of Education, "A Directory of 3660 16mm Film Libraries," Supt. of Documents, Washington 25, D.C., 1958.
4. 1959 "Annual statistical report of the photographic industry in the United States," *Photo Dealer, 25, No. 7:* 63–64, June 1959.
5. The Public Opinion Research Index for Industry, "How to Get the Most From Company Motion Pictures," Opinion Research Corp., Princeton, N.J., July 1957.
6. "Long-lived films," *Film Media, 3, No. 2:* 11–13, Apr. 1959.
7. Association of National Advertisers, Films Steering Committee, *The Dollars and Sense of Business Films*, Syracuse University Press, Syracuse, N.Y., 1954.

The Challenge Facing the American Film Producer

By HENRY USHIJIMA

The producers of both entertainment and commercial films are considered: the former must face the challenge of the home TV set and must create significant films for the motion-picture theater; and the commercial producer must make the client's problem his own problem and give to it not only his specialized abilities but also a lively and profound interest.

IN DISCUSSING the topic, one has to immediately answer the question, "What kind of film producer?"

If we are talking about the entertainment film — the concept of the film we summarize in one word, *Hollywood* — the challenge facing the film producer might be said to be a wooden or plastic box found in millions of living rooms. In that comparatively small box can be found all of Hollywood's magic -- plus the miracle of electronics. Looked at from this point of view, the producer of theatrical films has two clear choices, either to create some magic which cannot be found in the TV box, or to use the facilities and know-how of Hollywood to capture the new medium.

Obviously, Hollywood is embracing both these alternatives. In a sense, the situation today is only technically different from that of yesterday. Hollywood was always basically an industry. Like any other industry, it occupied itself with putting out a product with maximum sales possibilities. At the same time, a portion of Hollywood (or a portion of Hollywood's time) was devoted to putting out pictures of artistic merit — pictures which justified speaking of the film as one of the Arts.

In essence, Hollywood is doing exactly the same thing today. The difference lies in the fact that the bulk of its product — the routine result of routine work — is not being exhibited in theaters, but on the TV screen. On the other hand, an even more clearly defined portion of Hollywood is concerned with creating pictures of significance; and these, instead of being exhibited on television, are seen in movie houses. In short, they have a magic which cannot be found in that box in the living room.

These comments are not made to minimize the dislocations and hardships which television has brought about in Hollywood. (In the first place, too many of our friends out there have suffered from them.) But we should make it clear that, in the long run, the crisis is temporary for Hollywood — that is to say, for the film producer — and permanent for the exhibitor, for the operator of motion-picture theaters. Enough people will get out of their homes to see pictures as different as *Marty* and *The Ten Commandments* to make film producing profitable; but obviously film exhibition has to, and is, tailoring its investment to the size and character of the new audience.

With respect to the majority of Hollywood producers, then, we can say the challenge is twofold. There is the perennial challenge of trying to outguess the public on what it wants to see; and there is the new challenge of a vastly different marketing system to which they must tailor their product and their methods of production. With respect to those producers, largely independent, who continue to produce for theatrical exhibition, the challenge is immensely more difficult. In a word, what they have to do is to make good films — and this, like writing a good book, or producing a good play, or painting a good picture, is not easily done. And in a world as complex and strife-torn as ours, it is a doubly difficult assignment.

Now a few words should be directed to a subject closer to home for most of us — the challenge facing the producer of commercial films. Let us, to begin with, make a distinction between theatrical films and commercial films. Commercial films are almost invariably characterized by a limited, and usually quite specific, objective. We use many different forms and methods; but generally speaking, our objective can be put in a few words: show how this process works, show what this product will do, convince this group of people, get over that idea.

In short, the commercial film producer works in the closest relation with American Business. He simply brings his special talents to aid in the accomplishment of a task important to the given company or industry group. A commercial film producer, then, is one whose specialized abilities are used to help solve a problem or take advantage of an opportunity. And I would say, with all the seriousness at my command, that the very first challenge facing a commercial producer is to be *interested* in the problem or opportunity. If one cannot develop a lively and profound interest in the problems which a client brings to a producer, one will be neither happy nor effective in his work. I would go so far as to say that, assuming a professional knowledge and background in film-making, the basic qualification of a producer (and his organization) is this factor of interest. Let me expand that just enough to show how it leads to a second challenge. When a producer is genuinely interested in his client's business; when he has worked with, and comes to know, the people who are building that business; when he has wrestled with and analyzed the given problem in a cooperative effort with the people representing the client; then he finds that he has been facing a second challenge, the challenge of making the *client's* problem *his own* problem. Let me give an example.

A company came to me to have a film made. It was a small company, just beginning in its field. It had made a net profit the previous year of around $60,000, and here it was, willing to spend $15,000 on a film. To those of us who worked on the film, the realization that the company was spending a quarter of its annual profit on this single project represented a tremendous responsibility. Without attempting to assign credit, let me say that the film was highly successful. *Why?* I believe it was because we all shared the client's hopes; we shared his sense of urgency; in short, *His problem became our problem.*

One might feel that it is easier to develop interest in a situation of that sort, with a small company in which everything is quite personal, than with a large corporation. One might feel that when some industrial giant spends 50 or 75 or 100 thousand dollars on a film project, the sense of urgency is lacking; it is such a small percentage of the money they spend. But this is to forget the vital heart of the matter: that the producer works not just with the business, but with people. Somewhere in that giant corporation is a person or a group of people to whom the effectiveness of that film is a vital matter, because they are charged with the responsibility of having it made. If one's interest is in people, and in helping people accomplish their task, it doesn't matter what size the company is. The challenge is still the same: to work with someone else's problem with such an interest that its solution brings personal satisfaction, not only to the client, but to the producer.

It may seem strange that I have ignored so many important challenges to concentrate on this simple factor of interest. But I believe that interest, when coupled with know-how, is the foundation of successful commercial films — and

Presented on October 21, 1958, at the Society's Convention at Detroit by Henry Ushijima, John Colburn Associates, Inc., Wilmette, Ill.
(This paper was received on September 24, 1958.)

indeed, the foundation of a successful film-producing business. We are a service industry, and the value of our service depends upon how closely we identify ourselves with those for whom we perform the service. And to the extent that our services are of real and tangible value, they will be sought. Which is another way of saying that the fundamental challenge to a producer of commercial films is to think of himself, and make himself, a valuable partner to American industry. We exist and prosper to the extent that we serve American business and those who build it.

Producing the Sponsored Documentary Film

By HENRY USHIJIMA

There are some special requirements and techniques related to producing sponsored documentary films. The documentary is different from the story-film not only in preparation required but also in basic approach.

PROBABLY NO word in the motion-picture dictionary has been subjected to so much loose usage as documentary. There are company-history documentaries, product documentaries, sales-technique documentaries, and quite possibly on Madison Avenue they're even calling TV spots that tell how fast certain products get from the stomach to the bloodstream — medical documentaries. Of course, in Hollywood, documentary is, and always has been, a dirty word — dating back, perhaps, to the time when Robert Flaherty's *Moana of the South Seas* flopped at the boxoffice in no uncertain terms. The dictionary, having suffered no financial loss, manages to be both objective and specific: "a motion picture that records news events or shows social conditions without fictionalization." Let's accept that, as a starter.

In distinguishing between a "story-film" and documentaries, it is fairly obvious that the former is concerned with development of a plot, whereas the documentary's primary task is exposition of a theme. The two have very little in common in matters of approach, technique and production responsibilities. In the story-film, it is fair to say that the director is the key figure. In the documentary, and this may raise some eyebrows, it is the editor who exerts the determining influence on the shape of the film. Now, that is not to say that the term editor includes only the man at the cutting table. The documentary director, during shooting, should properly perform a combined director-editor function; and prior to that, the writer on the job should similarly anticipate end results and function dually as writer-editor. For a supporting opinion on that, the following is quoted from the book, *Documentary*, by Paul Rotha:

"Not until you come to cut do you realize the importance of correct analysis during camerawork and the essential need for preliminary observation. For unless your material has been understood from the inside, you cannot hope to bring it alive. No amount of cutting, short or otherwise, will give movement to shots in which movement does not already exist. No skill of cross-reference will add poetic imagery to your sequence if you have been unaware of your images during shooting. Your film is given life on the cutting bench, but you cannot create life unless the necessary raw stuff is to hand. Cutting is not confined to the cutting room alone. Cutting must be present all through the stages of production . . . script, photography and approach to natural material . . . finally to take concrete form as the sound is added."

Thus, ideally, the perfect documentary would be one in which the writer-director-editor functions are performed by a single person. Unfortunately there aren't many triple-threat geniuses around in the industry, probably because we have necessarily had to specialize. Even Flaherty didn't do his own editing — at least not in his later works. But the next best thing is a very close collaboration, from the very outset of production, among writer, director and editor. That, I submit, is one of the first ground rules of successful documentary production.

Now we come to a term that is usually associated with the chief opinion-maker of a daily newspaper — editorial honesty. It pertains to the documentary film-maker, too. It is to the documentary what artistic integrity is to the story-film. Without editorial honesty, the newspaper editor descends to the lowly rank of propagandist — and so does the film-maker. And just as the former must resist dishonest advertiser bias, the film-maker must resist sponsor pressure if it is dishonestly motivated. The documentary stands or falls on the truth of what it has to say. We should call this ground rule number two.

This is not to imply, of course, that the sponsor is not entitled to a voice in the project. He's paying for it, he's the customer, and without him the film probably wouldn't be made. In most cases it will be intended to serve some valid company purpose — or may, simply, be a goodwill gesture in the public interest. But, in any event, sponsor rights do not include wilful and deliberate falsification or distortion of facts.

It was stated earlier that the documentary has, as its primary task, exposition of a theme, which may be extended to say exposition *and interpretation* of a theme. And that adds another major responsibility. Most documentary subjects — whether an event, a project, a thing or a concept — largely dictate their own exposition. They write their own story, so to speak, as far as *what* happens is concerned. But the emphasis, both seen and heard, can be controlled by the film-maker. His *interpretation* of the happenings will, in most cases, have a dominating influence on the film's audiences. And there is more than honesty involved here. Knowledge is required. He must know his subject well enough to qualify as an expert, or his interpretation will almost certainly be inept, incompetent and probably inadequate. So, "Be informed," is ground rule number three.

Now, to the uninitiated, it might seem that the documentary, and especially the documentary-report, is the easiest of all possible films to make. Not so! Oh, it's true that in most cases you start with a ready-made subject, whereas before there can be a *story*-film, the subject must be created, the story must be written. But once you have script in hand, production is a fairly orderly business. There is a sound basis for planning and scheduling — and you know exactly what you have to put in front of your cameras to effect the transfer of story from script to screen. But the documentarist — ah, he'd better know how to "shoot from the hip," or not pack a gun. His finest opportunities may be the impromptu happenings that can't be anticipated. You just pray, live

Presented on October 20, 1958, at the Society's Convention in Detroit by Henry Ushijima, John Colburn Associates, Inc., Wilmette, Ill.
(This paper was received on May 20, 1959.)

right and try to be ready for them. Then, as they say in *My Fair Lady*, "with a little bit of luck" things will turn out fine. Maybe.

Up to this point the emphasis, for the most part, has been on the documentary in general. But the subject can be somewhat more specific: filming conventions, assemblies and special events. Where do we begin?

First, we should decide on a point of view. Basically, this narrows down to a choice between subjective and objective — involved participant or detached observer, although it is sometimes possible to combine the two. It is to some extent a matter of opinion, but we believe the objective viewpoint is most effective when treating a complex and sometimes controversial subject like an assembly or a convention. It is in the special event — an automobile race, a fishing derby or even a selling contest — that the subjective approach seems to work out best, because it tends to evoke audience participation. Thus, through the familiar device of mounting a camera on a racing car or boat, the film audience can experience the event from the driver's-eye point of view, which is certainly more exciting than seeing it from the grandstand. Couple that with a first-person narration — the driver thinking out loud — and the illusion is quite complete. Old ladies in the audience will faint, in their excitement — young men will exhaust themselves holding tight on the turns and giving 'er the gun on the straightaway — and a fine time will be had by all.

The illusion of reality — that is really what we are after here. Else why go to the expense of using the film medium to tell the story of an event, or a convention? Much cheaper to read about it in the newspaper — or get hold of the minutes — or study the official reports. But somehow words on paper never quite bring an event to life the way a film does. Reports are dull stuff, but a film — well, that's the next best thing to being there. In fact, sometimes, if it's properly made a film is better than being there, because the camera eye far surpasses the human eye in its ability as a keen and critical observer. Film has the ability to synthesize a complex series of events into something meaningful and easier to comprehend.

(At the Convention film clips were shown to illustrate factors and techniques involved in the production of two documentary films, one of the Lutheran World Federation Assembly and one of a National Aircraft Show.)

Low-Cost Movies for Business

By FRED A. DENZ

The advent of high-quality 16mm cameras and magnetic-optical projectors, coupled with the new, faster film emulsions, provides increased opportunities for business and industry to use low-cost, internally produced training films. As an illustration of such possibilities, the author describes the production and use of films in connection with his company's Employee Suggestion System.

The low-cost movie has a very definite place in many businesses today; and although the maker of these films is necessarily limited by the equipment he uses and his own lack of professional experience, these do-it-yourself movies will ultimately create more business for the professional producers.

The wise beginner, making a picture for his firm, will recognize his own limitations and will not attempt more than the basic fundamentals to achieve the initial mission. He will keep his movies as simple as possible. He will use no special sound effects, voices or trick photography. He will try to work as much as possible with one lens. He will avoid fades, dissolves, wipes and musical backgrounds. Although such movies are often used for special sales efforts to limited customer audiences, they turn out best when confined to an in-company audience which will hold within limits the niceties required.

The advantage of these movies to the professional who may not have been able to gain an audience with the company management are twofold: first, the movie is going to make more people in management conscious of the advantages of an audio-visual program; and second, it is going to give them a taste for movies and a desire for a more professional job. There are many companies which avoid any sort of audio-visual program using movies because of the cost involved. More important, they do not know or do not realize what such a program can do for them in training, in sales and in public relations.

Aid in Selling Heavy Equipment

An example of companies that may find the movie helpful is one selling equipment so bulky that it is impossible for the salesman to transport it from prospect to prospect. It may well be complex equipment which must be seen in operation to be appreciated. Usually it is difficult for the salesman to arrange for his prospects to visit other plants. Someone in the company decides to make a movie of company installations, and does it with amateur cameras. Movies, even first attempts, can be powerful sales tools. They sell the equipment. From then on, any commercial film organization representative will find that company a prospect for a professional motion-picture program. Obviously it will cost more money, but it will sell more goods too. The professional producer knows all the approaches to business and consumer audiences alike, and can easily prove definite results to any company which has seen an example of the effectiveness of a motion picture.

At the Remington Rand Division of Sperry Rand Corp., movies made by this writer as director of the Employee Suggestion System are being used internally to give added impetus to the program. My office also heads the suggestion system committees in 29 plants. With only a limited budget, I have found that by using motion pictures made, edited and presented by me, I can do my job better. My work is easier for me and is more effective for the company.

Making a Suggestion System Work

In suggestion work, the most important salesmen are the supervisor, the plant foreman and the office supervisor. My job includes selling the suggestion philosophy to supervisors so that they will in turn enlist employee interest and participation. Although charts, posters, pamphlets, displays and other visual aids have proved very helpful, none have been nearly as effective as movies. Wherever a suggestion is covered in one of the films, an effort is made to show both the "Before and "After" scene and the individual who made the suggestion. Five such films have been made by the Remington Rand Division. The first three were black-and-white, the last two in sound and color. Each of them cost less than five hundred collars.

The first step in making one of these films is to determine the plant where the operation of the Employee Suggestion System is to be photographed. Then the picture is produced much as some of the old-time movie directors used to do it—extemporaneously. Shooting starts by making pictures of highway markers and route signs to help identify the plant location in the titles and introduction of the

This paper is based on a talk presented on October 21, 1958, at the Society's Convention at Detroit by Fred A. Denz, Manager, Suggestion Plan, Remington Rand Division of Sperry Rand Corp., 30 Rockefeller Plaza, New York 20. (This paper was received on April 9, 1959).

film. Frequently several plants will be featured in the one film.

Once in the plant, the story is gotten under way by making pictures of the products manufactured there. Then follows a tour of the factory, starting at the raw-material and emerging at the finished-product end. Presenting the suggestions which have been put into practice at their respective locations in the plant's manufacturing process tells the story in simple continuity.

In addition to illustrating the value of the employee suggestion system, this format is more interesting than one in which the film hops from one suggestion to another for the sake of the suggestions themselves. This type of movie also serves to increase viewer knowledge of the products manufactured by the entire Remington Rand organization.

Employees as Actors

Plant personnel are used as actors, dressed the way they are on the job. The entire project is handled by one man: direction, photography, cutting, timing, script writing, sound recording and eventually showing the films in supervisory sessions. One of the vital points is to be extremely careful not to disrupt plant production too much when shooting. By operating this way the photographer is far more popular in the plant than if he came in with a crew and started rearranging production lines and equipment.

This hit-and-run technique has other advantages. These films are shown to plant supervisors, a highly critical, informed and vocal audience. If the job were too polished, the photographer could be accused of frosting the cake.

To avoid the drabness of showing one improvement idea after another, an attempt is made to weave the suggestions story into a yarn by telling something about the location, the people, the products and the production processes of each plant, plus anything else that helps to create audience interest. Then, in the course of a thirty-minute meeting of plant supervisors, they may be shown films of three or four of the company's distant plants. Thus they may see the final assembly of products for which they have been making parts for years. They see people they have written to and talked with over the phone for years but whom they have never met. They get a better picture of the company and its size. They see the benefits of the Employee Suggestion System and pass their enthusiasm along to the employees.

Here as in many other companies the maker of low-cost movies in business is doing an indirect selling job for the professional. He is getting people is his company conscious of the benefits of audio-visual programs, he is whetting their appetites. The high-quality 16mm cameras, magnetic-optical projectors and the new, faster film emulsions now available have increased the possibilities for business and industry to use low-cost, internally produced training films. Many of these films will be produced by plant photographers and employee camera "experts" who will be opening the door for the professional cameraman to take over later.

Filming for Educational Television

By DAVID W. JOHNSON

The varied subject matter of educational TV programming dictates a flexible approach to filming. The techniques differ from those used in commercial TV filming in that they must meet individual situations as they arise, with no sacrifice in quality. Further, the budget for an educational program is frequently less than one-twentieth that of a commercially filmed program of the same length produced by comparable techniques. The Staff Production Unit of the University of Southern California, Department of Cinema, has produced four series, totaling 44 half-hour programs for educational TV. Some of the unique production problems presented by each of these series are discussed, together with their solutions.

IN THE PRODUCTION of program material for educational television, the producer is faced with two basic problems. First, he should create a product which is of the highest possible quality in both content and technical considerations. Secondly, he must do this within a budget which is ridiculously inadequate for the purpose.

The *content* of an educational program must be presented in such a way that it will first attract, and second, hold the viewer's attention. Historically, television is primarily an entertainment medium, but there is no reason why an educational program cannot also be entertaining, providing the entertainment values do not overshadow or confuse the educational content.

Many educational programs (too many, perhaps) are set in the "lecture" format. Here the burden of success or failure falls upon a single personality. It is not enough to take an "expert" on a particular subject, put him in front of a camera, let him expound in the same way that he has been doing for years in front of a captive audience in his classroom.

The TV audience is anything but captive — one little flick of the wrist and it is gone. The TV lecturer, therefore, must not only be thoroughly acquainted with his subject, but he must also be a performer. He must have the talent to communicate his knowledge and ideas in a manner which will interest and excite the viewer.

The success of Dr. Frank Baxter's many series seems to bear out this premise. On many subjects Baxter is no scholar, nor even an "expert," and he is the first to admit it. But he is a performer. He has a personality which can attract and hold an audience.

It is, then, the responsibility of the producers to inject those elements of showmanship which can make an educational program both an exciting and an enlightening experience.

All this must be done within a budget which is frequently less than 5% of what the "competition" is spending for a product of comparable length produced by comparable techniques. The 15 half-hour Baxter programs produced at the University of Southern California, for example, cost less than one *I Love Lucy* show.

Educational vs. Commercial Techniques

From the *technical* standpoint, an educational program must be, at the very minimum, as good as the poorest commercial TV film recording and preferably as good as the best filmed program. The advent of video-tape recording has improved the average picture quality of *commercial* television, but in all likelihood it will be some time before every educational TV station can afford this equipment. Educational stations, therefore, must rely on 16mm film for their recorded program material — either as TV film recordings or as direct film productions. It is generally conceded that an image recorded directly on film is superior to that of an image recorded secondhand from the face of a

---

Presented on October 22, 1958, at the Society's Convention at Detroit by Herbert E. Farmer for the author, David W. Johnson, Dept. of Cinema, University of Southern California, University Park, Los Angeles 7.
(This paper was received on May 19, 1959.)

Fig. 1. Typical camera setup for shooting to playback, *Musical Forms* series. The lighting is more like that for motion-picture films than for TV.

Fig. 2. A moment in the production of *The Written Word*. Majority of lighting units were rigged above the set to facilitate mobility of cameras and mike boom, but typical "flat" TV lighting was avoided.

TV tube. Direct production on film, therefore, seems to offer the greater possibility for high technical quality program material.

The "stop and go" technique of shooting provides the opportunity for retakes if necessary, and the ability to exercise more precise control over such factors as lighting, camera placement, movement and sound recording. These advantages plus the care and precision of the film editing process all add up to a more polished final presentation. Control plus quality are the elements of film-production technique which make it the most appropriate for TV programming.

At the University of Southern California, Department of Cinema, complete 16mm film production facilities are intended primarily for the use of students enrolled in the academic program. Through a sometimes rather hectic process of coordination, these facilities are also made available for productions by the Staff Production Unit. This group is made up of faculty and staff members, already on salary, who are given production assignments as a part of their duties. Under this arrangement, four series, totaling 44 half-hours, have been produced in cooperation with the Educational Television and Radio Center of Ann Arbor.

Filmed-Program Techniques

The first series, produced in the summer of 1955, consisted of 6 half-hour programs called *Musical Forms*, on the subject of Music Appreciation. This series featured the Paganini String Quartet (at times augmented) and its leader, Henri Temianka. These programs were more nearly "films," as they are usually thought of, than any of the later series, simply because the nature of the subject permitted almost exclusive employment of film techniques in production.

For this series there were no scripts. There was an outline for each program listing the music and, in general, the comments of the narrator. The music itself became the "script." The director, and later the editor, were guided by the scores in determining camera angles and cuts. This permitted a complete breakdown of the 35 musical numbers making up the 6 programs into camera angles which could then be grouped for economy of shooting. This "out of continuity" method of production is pure film technique.

The musical selections, averaging about three minutes each, were all prerecorded and the film was shot to playback. The musicians, not being thoroughly acquainted with this process, were frequently more concerned with hearing their performance on playback than in maintaining synchronization. As an aid to the editor in correcting these discrepancies and also as a time-saving factor in shooting, most camera angles were shot all the way through each musical selection. The connecting explanatory narration was photographed with synchronized sound after the photography of the musical numbers was completed. The music was recorded in 6 half-day sessions and the photography in 9 eight-hour days — 6 on playback to shoot all the angles on the music and 3 days of synchronized sound with the narrator.

Equipment Used

For this series a 16mm Mitchell with 1200-ft magazine was mounted on a dolly. Twelve-hundred-foot rolls of film were used to lessen reloading time. A majority of the standard motion-picture lighting units were rigged overhead to clear the floor for rapid changes and to allow as much camera mobility as possible (Fig. 1). A dimmer-bank saved more than enough time in lighting to offset the rental cost of this equipment. Stancil Hoffman S5 16mm magnetic equipment was used for both sound recording and playback. The crew consisted of a director, production manager, three-man camera crew, two electricians, two grips, make-up man and sound crew.

The major problems in this series were really those of scheduling and planning. It was quite a task to try to schedule the services of 15 very busy (and at times temperamental) musicians in an efficient manner and stay within the very limited budget.

In the summer of 1956, the second USC series, *The Written Word*, was filmed. These 15 half-hours on the history of written records with the old master himself, Dr. Baxter, were essentially filmed TV programs. He felt at home before the live TV cameras, but had some trepidation about the prospects of having to break the continuity of his lectures by shooting them in little bits and pieces. We compromised by shooting in bigger bits and pieces, using a multicamera setup. Basically, then, we were using TV methods with the added controls permitted by film techniques. Since we were working with no scripts whatsoever, the decisions — arrived at, incidentally, immediately prior to shooting — as to where to break each lecture into shooting scenes were based on what he was going to *do*, rather than on what he was going to *say*. The number of setups per show ranged from as few as 2 to as many as 12, depending upon the action and the type of graphic material being used. No attempt was ever made to shoot an entire program in a single run of the cameras.

In shooting *The Written Word*, two 16mm Mitchells with 1200-ft magazines

and blimps were used, running simultaneously. One camera was mounted on a crab dolly (which might be called the greatest innovation since the invention of the wheel). This dolly not only provided complete mobility of the camera during shooting, but perhaps more important, saved immeasurable time in permitting rapid and accurate camera positioning for a new setup. The second camera was mounted on a hydraulic tripod which could be locked down to provide a steady fixed support, but which permitted the rapid movement of the camera to the next setup (Fig. 2).

Synchronization

The technical problem of synchronization was solved simply by running both cameras all the way through the program. This meant the use of twice as much film as necessary, but the added expense was justified by the time saved later in the editing process and in giving the editor more freedom in cutting.

The major problem was from the director's point of view. Without a nice little monitor on which to see the action at all times as the camera saw it, the best he could do was to hop from viewfinder to viewfinder, peering past heads, trying to see what was going on.

In general, one camera was used as a medium-to-long-shot camera, primarily to cover any unplanned or unexpected moves of Dr. Baxter. There were never any rehearsals. There was no time for such luxury. This camera was on the dolly so it could be moved if desirable.

The other camera was set up for a medium close-up including both Baxter and whatever graphic material he was using. Unfortunately, since Baxter is a great disrespecter of cameras, he would frequently play to the wrong camera, but the problem was minimized by placing the two cameras as close together as possible. Since only he, and never the director, knew in advance what was in his mind, any kind of red-light cue on the cameras would have been pointless.

Frequently, close-up footage was required of Baxter pointing out various things on charts, pictures and the blackboard. When possible, these inserts were made simultaneously by the second camera. On other occasions these inserts were shot to a playback of Baxter's own dialogue to which he was able to time his movements very well.

This series was shot on one set, simulating his study, on our sound stage at the rate of one program per day. Actual shooting time was about six hours per program. The set was lit by standard units rigged overhead with only the fill lights on the floor. A high lighting level was used so that lenses could be stopped down to $f/5.6$, producing a depth of field which helped to minimize follow-focus problems created by unpredicted subject or camera movement.

On-Location Production Problems

The Merrell Gage series, *Visits with a Sculptor*, presented some entirely new problems. In the first place, these 10 half-hours were shot entirely on location, primarily at Mr. Gage's studio, some 17 miles from the University.

The working area measured 16 ft square with 13 ft to the rafters. This space was already half filled with pieces of sculpture, large and small, in various stages of completion. By the time the production equipment was added, to say that it was crowded would be a gross understatement. After the first day's shooting, the two-camera technique used on the Baxter series was abandoned simply because of the physical limitations of space. The remaining programs were shot with a single Mitchell for the dialogue and a Cine Special for wild insert footage.

Again there were no detailed scripts, only rough outlines. The nature of the subject dictated that each program had to be shot in continuity, but broken down into sections. One just does not carve a head of Washington out of a block of marble in half an hour. As a result, the opening of the program was made first, another section two or three weeks later, and so forth until the completion of the bust, perhaps two months later. However, shooting for several programs progressed simultaneously.

Working with a single camera and with this type of subject matter at times presented serious problems of continuity. Frequently it was impossible to use the standard film technique of repeating part of an action in a new camera angle to provide the editor with an overlap of action on which to cut. There is difficulty in keeping plaster used in making a mold from hardening, so that it could be wiped off and splashed on again for the benefit of the camera. Also, with no written dialogue, there would have been a double problem for the editor in trying to make sense out of both picture and track. For these reasons, we resorted to what we called the "bridging insert." At the end of a take the cameraman would dash in with the Cine Special and shoot an insert of the material on which Mr. Gage was working, in order to bridge between the previous take and the new setup (Fig. 3). This might have been at the place where it was planned or simply where Mr. Gage, as he put it, "ran out of gas." The technique worked quite successfully.

Shooting in such a confined area presented a number of problems, but finding ways to vary the camera angle to avoid monotony was perhaps the biggest problem.

Lighting, which might have been the major concern, was aided by the presence of a large north skylight which flooded the room with a soft, diffused light. In order to raise the intensity to 250 ft-c, two 5-light Colortran units diffused by spun glass were rigged and operated through a transformer off the regular house power. A few "babies" were rigged for backlights and kickers, and a fill on the floor completed the rather simple lighting arrangement. This type of lighting gave the soft "skylight" feeling desired and presented few difficulties.

The problems of the sound department were those usually found on location — the mockingbirds in the garden, the neighbor's cat on the roof, and a room designed with little concern for acoustics.

Lecture Series Presentation

The fourth series, currently in release, is *Patterns of Life*. These 13 half-hours deal with the chemical nature of the basic processes of life and are presided over by a young biochemist of Univ. of Southern California, School of Medicine, Dr. Paul Saltman. In this series a rather "offbeat" approach is used to make what is essentially a lecture into something interesting and exciting. Everything about the series was designed around the personality and teaching techniques of the speaker which, to put it mildly, are hardly those of the "college professor" stereotype.

The set was designed simply to provide a rather neutral background for the action. By incorporating a rear-projection screen into the set, we were able better to integrate the presentation of a great deal of the visual material.

From a production standpoint, the two-camera technique was again used. Once again, the outlines only remotely resembled scripts and the crew never knew in advance what was going to be said. With this particular personality, anything could happen, and it frequently did.

Much fuller use was made of the camera movement made possible by the crab dolly. Even with some rather complicated dolly shots which consumed more production time, each program was completed in one day (Fig. 4).

Lighting and sound-recording problems were complicated by the unusual design of the set and the fact that Saltman is 6 ft 6 in. tall, the set only 9 ft high and the trusses of the stage only 2 ft above the top of the set. Rear-screen projection incorporated as a part of the set presented some problems because of the inadequacies of space. Lighting balance and the elimination of hot spots on the rear screen were considerably simplified through the use of a Polaroid camera. By shooting Polaroid stills of each setup involving rear-projected slides, we were able to immediately see any discrepancies between the intensity

Fig. 3. On location in sculptor's studio for *Visits With a Sculptor*. Emphasizes compressed nature of production area. While the author shoots an insert with the Cine Special, the Mitchell is set up for the next dialogue take.

Fig. 4. Preparing for an involved dolly shot for the *Patterns of Life* series. The crab dolly permitted complex camera movement without loss of valuable production time.

of the image on the screen and the foreground illumination and could make adjustments in the lamp intensity of the slide projector to compensate. This technique also showed up any unevenness or "hot-spots" in the projected image on the screen.

The relative importance of sound is frequently underestimated in television. The unsightly lavelier or hand microphone takes much less time and effort than a boom mike or fish pole with its attendant lighting problems and extra personnel. More frequently, perhaps, the advantages of dubbing, in smoothing out and equalizing dialogue and in adding music and effects, are eliminated in the interest of economy. Although at times these procedures seemed like solutions to economic crises as they arose, other steps were taken to circumvent this extreme.

Timing of each program to fit a slot of 29 minutes $\pm$ 5 seconds was another problem. Although this problem ultimately falls into the editor's lap, it is helpful if some sort of rough timing is done during shooting. It is essential to provide the editor with more than enough footage for each program, but not too much more. In spite of the best efforts, one of the sculpture films ended up in a first cut to run 45 min. It was time-consuming to determine what could be eliminated and still end up with a program of the right length and which made sense. Conversely, on a few occasions, the mental editing during shooting turned out to be a little too inaccurate, and a program ended up two or three minutes short — a little too much to make up with titles. In these cases, it was necessary to shoot more material, which did not help the budgetary problem.

Educational television is a growing concern. With more than 30 stations now on the air with an estimated total audience of twelve million viewers and with the probability of a network within a few years, educational television is a power for good which cannot be neglected. Regardless of the future role of the motion picture, video-tape or TV film recording, the essential elements for the improvement of this important educational medium are significant content, better technical standards and showmanship.

Implications of Continental Classroom for Open-Circuit Television Teaching

By EDWIN P. ADKINS

The technical aspects of production of a network television class are analyzed, and an accounting of costs is presented. Problems of distribution are discussed. Ways of utilizing special properties of television in presenting courses at a college level are emphasized. Implications of *Continental Classroom* for special group education, for general adult education, and an analysis of the role of network television in education are presented.

THE *Continental Classroom* physics series is the first nation-wide TV college course.* This pioneering effort is being carried by 150 TV stations and the course is being offered for credit by 250 colleges and universities. The college effort is coordinated by the American Association of Colleges for Teacher Education.†

The purpose is to provide those interested, particularly high-school science teachers, with up-to-date information concerning recent developments in physics, and to demonstrate techniques essential to effective teaching of basic principles of physical science. It is planned as a lower-level graduate course for those who have some background in physics and mathematics.

Necessary Elements of a Good ETV Course

The first ingredient of a successful educational television (ETV) course is a teacher who combines teaching skill with a solid reputation as a scholar in his field. Both are necessary if the course is to be truly successful. This objective was achieved in the selection as national teacher of Harvey E. White, Professor and Vice-Chairman of the Department of Physics at the University of California, Berkeley. Over a period of 33 years Dr. White had demonstrated that he was a master of the art of teaching, and, at the same time, the wide acceptance of his textbooks, his connection with the Manhattan Project, and his position as consultant to the Atomic Energy Commission placed his reputation beyond question. Dr. White was given complete freedom to structure the course as he thought best.

That Professor White has lived up to expectations in his presentation of this first national course has been amply demonstrated. Researchers have established that approximately 300,000 people viewed the course each morning at 6:30; that 28,000 individuals purchased lesson synopses in the first semester; that thousands of textbooks were sold; and that 5000 teachers and others enrolled for credit and audit in the 250 participating colleges. Preliminary evaluation figures, based on personal interviews, indicate that more than 90% of those regularly following the course find it of great usefulness.

The second essential element of a good ETV course is well-financed production. Too often ETV courses have been run on a shoestring, without proper technical staffing and facilities. *Continental Classroom* has the advantage of the production know-how of NBC; appropriate equipment is available; and all facets of production are handled professionally.

Budget and Distribution

All this takes money, a great deal more money than was ever before alloted to an ETV program. The series (160 broadcasts) was budgeted at $1,112,000. Of the total, $560,000 was set aside for production expenses, $425,000 for longlines and associated distribution costs, $27,000 for contingency purposes, and $100,000 for administration, coordination and evaluation of the course. The bulk of the last item will go to evaluation.

Among the production items, $145,751 goes for staff, office expenses, talent and guest performers; $220,960 for basic production costs (as $71,392 for studio rental, $38,400 for stagehands, $19,200 for graphic arts and $12,000 for properties); $127,314 for making and distributing ten kinescope copies; and $154,649 for video tape.

The shows are taped and recorded on film in the NBC studios in New York about two weeks prior to air date. One tape is shipped to Los Angeles and the other remains in New York. Hence when the show goes on the air, at 6:30 A.M. local time, the Eastern time zone is fed from New York and the Central and Pacific zones from Los Angeles. Thirty-one stations, including those in the Mountain time zone, are serviced by kinescopes which are distributed from New York. The show is carried in 46 States and Puerto Rico.

Professional Staff Essential

One of the chief differences between an ordinary and a superior TV class is the skill with which the equipment and special devices are used on the show. All TV productions have cameras, for example, but not all have skilled directors and cameramen. All studios or studio classrooms have lights, but not all have lighting technicians who can make the most effective use of lighting. All TV classes have teachers, on both closed and open-circuit, but most have not been carefully chosen with TV goals in mind. Many teachers presently handling TV classes are there for no particular reason other than that they were "volunteers." Quite often the results show it, and the accumulated effect on TV education is disastrous.

It is in the rehearsal sessions that all elements of the TV presentation are brought to bear upon the finished performance. It is here that the producer, the director, the cameramen, the stagehands, the teachers and others involved take the academic material and equipment to be used and adapt it to the TV medium. And it is here that the vast majority of TV efforts have completely failed. In too many cases there is no rehearsal and little prior planning. To show a piece of equipment in a TV laboratory demonstration can be wholly gratifying or totally thwarting to the student. It depends upon how clearly and effectively the equipment is shown. This effectiveness comes from teamwork on the part of teacher, director and crew, and can only be worked out in rehearsal. It is in rehearsal that shot-sequences and the use of special devices, such as the split screen, the close-up, superimposition and others, are imaginatively developed.

The narrow line between the mundane and the effective often lies in the kind of aids used, especially in the graphic arts area. Charts, diagrams and chalk-board work can be extremely effective provided these elements are properly planned, imaginatively shown and carefully integrated into the total lesson by director and teacher. This implies of course that such aids must be planned and executed in advance and

Presented on May 5, 1959, at the Society's Convention in Miami Beach by Edwin P. Adkins, AACTE National Coordinator, c/o National Broadcasting Corp., 30 Rockefeller Plaza, New York 20.
(This paper was received on April 10, 1959.)

* Sponsored by AACTE and NBC and supported by Bell Telephone System, Standard Oil Co. of Calif., Ford Foundation, Fund for Advancement of Education, General Foods Fund, International Business Machines Corp., Pittsburgh Plate Glass Foundation and U. S. Steel Corp.

† The nucleus of the *Continental Classroom* idea should be credited to Edward Stanley, Director, Public Affairs for NBC, and to E. DeAlton Partridge, Chairman of the AACTE Committee on Television Education, and Hilton Buley, a member of the Committee.

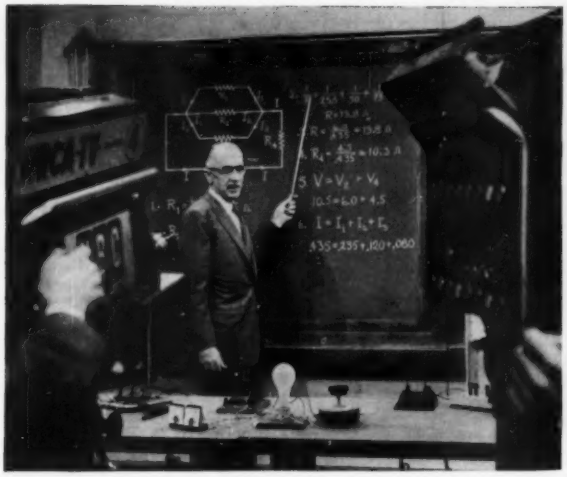


Fig. 1. Typical demonstration during TV physics lecture. Instructor is Harvey E. White, Professor of Physics, Univ. of California, Berkeley.

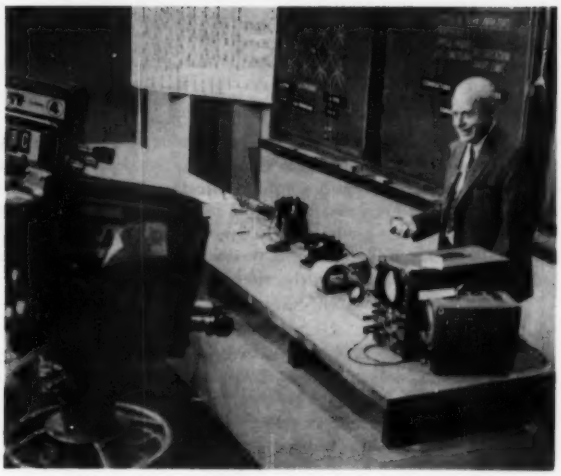


Fig. 2. Guest lecturer, Nobel Prize winner Walter Brattain, demonstrates equipment illustrating semiconductors in a magnetic field as he lectures on the subject of "Transistors." Lecture given on NBC set in New York for *Continental Classroom*.

that adequate help must be given the instructor in their preparation.

When we have learned two basic lessons, the TV medium will occupy an important place in education. These lessons are (1) that the TV medium is new, and that it *is* a *medium*, not merely another audio-visual aid, and (2) that TV teaching is expensive and must be properly financed if it is to be effective. Once the first condition is met philosophically by the teaching profession and the public, and when money is made available, the possibilities of TV in education are almost limitless.

Role of Network TV

TV can be and undoubtedly will be a powerful instrument of education. In general, network television should be looked upon as an available means for reaching goals which cannot be reached at all, or at least not as well in a limited time, by the colleges, universities and schools in their independent capacities.

Thus in the technical and special field where the audience is small when treated locally, the possibilities may be great when applied nationally. The present physics audience in the *Continental Classroom* is a case in point. There may be only a handful of interested persons in a given college area, or for that matter within the listening area of one station, but when telecast nation-wide the total audience, educationally speaking, is staggering. In these terms costs are nominal. Conservatively, 300,000 individuals watch *Continental Classroom* daily. The total cost of each program is about $6950. Thus the cost for each viewer is only 2½ cents a day. This same kind of special audience course could be produced for doctors, lawyers, home economists, engineers, office managers and many others.

The implications for national, regional, state and local television in the broad area of adult education are legion and perhaps obvious to the casual observer. Nevertheless it is timely to point to this facet of the situation when there is increasing attention being paid throughout the country to the needs of continuing education in general and to the need of the aging in particular. The use of TV can certainly aid in the solution of these problems.

Quite obviously TV is no panacea for all the problems of education. It is doubtful that it will significantly alleviate the teacher shortage, the lack of dormitories or classrooms, or the dearth of instructional materials now so painfully apparent in many of our colleges and school systems. Television cannot replace the classroom teacher, but rather it may help him do a better job.

The question of relative costs is an open one. Many believe that TV can make education less expensive without lowering standards. This may ultimately prove to be correct. In the opinion of this observer, however, this is an extremely dangerous ground upon which to justify the use of TV in schools. In the long run, total educational costs could be increased because of TV. The important consideration is whether or not education is improved. If education can be improved through TV, then its cost is justified. But neither a saving nor increased cost can be justified if education suffers.

Implications for the Future

Certain problems must be solved before TV teaching can reach its maximum efficiency. The question which dwarfs all others is what can be done to bridge the gap created when the teacher is physically separated from his students. This loss of intimacy is felt by both teacher and student. The values of immediate, and before and after class contact must in some way be compensated for. A great deal of research into the techniques and methods of learning as well as teaching by TV must be undertaken.

Financing is of course a problem, and a complicated one, since this will undoubtedly involve both governmental and private agencies in varying combinations and forms as TV teaching develops. Certainly this is a place where private industry can join with the educator to perform a real service for the nation.

Finally a major obstacle to be overcome is the availability of network time at all hours of the day. The commercial systems can be expected to go only so far in making such time available. Probably the ultimate solution will be provided by national, regional and state ETV networks. The nation can ill afford to delay the construction of the necessary facilities for too long. Educational time, even with the best and most up-to-date materials and equipment, is a valuable commodity in the year 1959.

Projector Noise Levels

By G. E. WHITNEY, M. T. BUCKELEW, J. F. McGRANE, and M. L. BARON

Analytical and empirical tests have been made to determine optimum noise levels of photographic projectors. It is shown that to achieve 96% "intelligibility" (per cent of sentences understood) the projector should have an articulation index (a quantity related complexly to noise and frequency) greater than 0.4. The index is simple to determine when the projector noise spectrum parallels the spectrum for ordinary speech, i.e., when it peaks near 500 cycles/sec. Measurement of the index is more difficult when the spectra are nonparallel.

IN THE COURSE of preparing coordinated Military Specifications for motion-picture and still projectors it became apparent that a serious deficiency existed in engineering standardization regarding noise-level requirements. Each of the three Services used different requirements and the task of combining these various specifications and requirements into coordinated documents proved to be unreconcilable. The Standardization Division of the U.S. Army Signal Equipment Support Agency, Fort Monmouth, N.J., as Department of the Army custodian in this area, suggested to the other Services that a competent study of the problem by a non-interested party could be used as the basis for its resolution. As a result of this suggestion, a contract was let with the American Machine & Foundry Co., Alexandria Division, Va., to perform the study under the management and control of the Standardization Division of U.S. Army Signal Equipment Support Agency. This paper discloses some of the results of that study.

This work is divided into two parts: (a) an analytical approach performed at the American Machine & Foundry Co., in Alexandria, and (b) an empirical approach performed at the Signal School, Fort Monmouth, N.J. All sound-level measurements were made at the U.S. Army Signal Equipment Support Agency Anechoic Chamber.

The Analytical Approach

This approach is based on a study by French and Steinberg[1] which discusses the factors that govern the "intelligibility" of speech sounds and presents relationships for expressing quantitatively, in terms of the fundamental characteristics of speech and hearing, the capability of the ear in recognizing these sounds. The relationships are based on studies of speech and hearing which have been carried on at Bell Telephone Laboratories over a number of years. One of the important formulas developed by French and Steinberg permits calculation of the signal-to-noise ratio necessary to achieve any particular value of the "articulation index." Tests conducted by Bell Telephone Laboratories and others have related articulation index to intelligibility expressed in terms of syllables, words or sentences understood. If an acceptable value of intelligibility expressed as per cent of sentences understood can be agreed upon and if a standard signal level corresponding to ordinary speech can be postulated, it becomes possible to calculate maximum permissible noise.

French and Steinberg, in their analysis of intelligibility of speech sounds, introduce and define a variety of quantities and concepts that are necessary to the development of the theory. One of these is the quantity W, explained as follows.

The intelligibility of the received speech sounds is related to a quantity which has been called the articulation index and designated A. It is a quantity such that increments ΔA carried by increments Δf of the speech-frequency range may be added together to obtain the total A. The maximum possible value of A is assigned a value of unity; the minimum value is zero.

Any increment Δf of the speech-frequency range may at best carry a maximum value of ΔA designated as ΔA_m. When conditions are not optimum for hearing speech in the increment Δf, this increment contributes only a fractional amount W of its maximum, or $\Delta A = W(\Delta A_m)$.

For convenience in making computations, the frequency range may be divided into 20 bands whose frequency limits are so chosen that the ΔA_m of each band is 0.05, i.e., one-twentieth of the articulation index of the full band under optimum conditions. The general procedure for computing the articulation index involves the determination of a value of W for each of the 20 bands, and substituting in the equation

$$A = 0.05(W_1 + W_2 + \cdots + W_{20}) \quad (1)$$

For noisy conditions, W has been determined as

$$W = \frac{1}{30}\left[B_e + p - 6 - m - (B(\sharp)X)\right] \quad (2)$$

where

W = fractional part of the maximum possible increment of articulation index ΔA_m carried by an increment Δf of the speech-frequency range when conditions are not optimum for hearing speech in the increment Δf .

B_e = the long average intensity per cycle level of the speech received over a communication system (in decibels above 10^{-16} w/sq cm).

p = difference in decibels between the intensity in a critical band exceeded by 1% of $\frac{1}{4}$-sec intervals of received speech and the long average intensity in the same band. French and Steinberg[1] inform us that for ordinary ranges of intensity $p = 12$.

m = a quantity to be considered when the level of a critical band of noise (i.e., effective level) is more than 50 db above 10^{-16} w/sq cm.

B = the long average intensity per cycle level of the noise received from all sources (in decibels above 10^{-16} w/sq cm).

X = a quantity whose value is negligibly small compared with B (it will be shown later that X can be neglected in our calculations).

NOTE: The symbol ($\sharp$) between two terms expressed in decibels indicates that they are to be combined on a power basis and then reconverted to decibels. In this equation the quantities that vary with frequency are usually specified at the mid-frequencies of the bands.

This approach provides a procedure by which, within the limits of the applicable postulations and assumptions, it can be determined if the noise produced by a projector (or any source of noise) will result in appreciable loss of learning. It must be assumed that the source of noise and source of speech are equally distant from the point of measurement or ear. Moreover, to utilize this approach, it is necessary to postulate an acceptable value of intelligibility and a standard signal level of speech. The reliability of the approach is heavily dependent upon how realistic and meaningful these two postulations are.

One source[2] gives 70 db above 10^{-16} w/sq cm as the level of average conversational speech at $3\frac{1}{4}$ ft; another source[3] lists normal conversation as 65 db above 2×10^{-4} dyne/sq cm at 3 ft. Still another source[4] lists average conversation as 60 to 70 db above 2×10^{-4} dyne/sq cm at 3 ft. Since for most practical purposes the two reference levels can be considered equivalent,[5] it is seen that the level of average conversation is in the range of 60 to 70 db, the precise level being largely a matter of how "average conversation" is defined and measured.

Presented on October 24, 1958, at the Society's Convention at Detroit by G. E. Whitney, M. T. Buckelew, and J. F. McGrane, American Machine & Foundry Co., Alexandria, Va., and M. L. Baron (who read the paper), U.S. Army Signal Equipment Support Agency, Fort Monmouth, N.J.

(This paper received in revised form on May 14, 1959.)

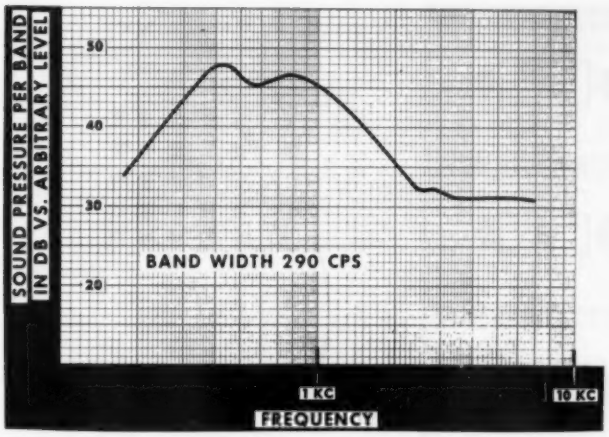


Fig. 1. Spectrum of 16mm motion-picture projector.

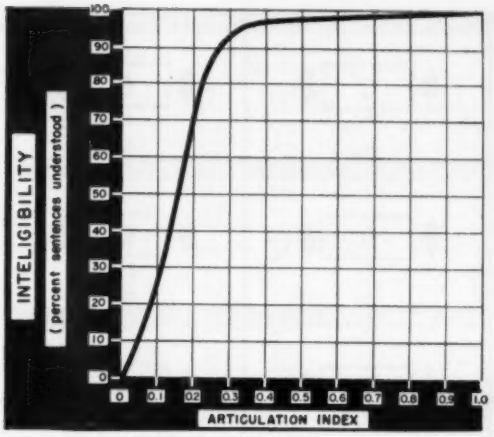


Fig. 2. Articulation Index.

It is more difficult to agree upon an acceptable value of intelligibility (which for this approach is taken to be per cent of sentences understood). Below such a value there would be "appreciable loss of learning." The question is, of course, what per cent of sentences understood is sufficient? The answer must be a compromise between 100% intelligibility — which would necessitate projector noise levels considerably lower than manufacturers are presently producing—and levels of intelligibility that are patently too low. The minimum acceptable value of intelligibility will fall somewhere in the considerable range between these extremes. Selection of this value is discussed in "Conclusions."

In the general case, the procedure for determining the acceptability of a projector in so far as noise is concerned is accomplished by the following steps:

(1) Measure the noise level of the projector (decibels above 10^{-16} w/sq cm) in each of the 20 frequency bands previously described. A technique for accomplishing this measurement is given as an appendix to this paper. The resulting curve is shown in Fig. 1.

(2) From Eq. (2) calculate W_1, W_2, W_3, ... W_{20}. It is essential that B and B_s be expressed in like terms, such as decibels per band or per cycle. This will necessitate reducing the postulated sound level of B_s to its components in terms of bands or cycles.[6]

(3) From Eq. (1) compute the articulation index, A.

(4) From Fig. 2, which is an empirically determined relationship between articulation index and intelligibility expressed as per cent of sentences understood, determine intelligibility. (This curve is reproduced from Ref. 1.)

(5) Compare this with a postulated acceptable value of intelligibility to see if it is acceptable. In this instance (Fig. 1) the energy of the noise spectrum peaks around 500 cycles/sec. The resulting curve of decibels vs. frequency happens to be very similar in shape to typical speech spectrum curves given in the literature.[1,6] A comparison is shown in Fig. 3. It can be seen that the difference in decibels between speech level B_s and noise level B is substantially constant over the frequency range involved. Thus, in Eq. (1) $B_s - B$ is a constant, with the result that W is independent of frequency. Therefore, the term X may be neglected entirely, and the other terms combined to yield

$$W = A = \frac{1}{30}(B_s - B + 6) \qquad (3)$$

From this expression and Fig. 2 the relations given in Table I are obtained. From these data, curves of intelligibility vs. noise level are plotted in Fig. 4 for two values of B_s (60 and 70 db) corresponding to the upper and lower limits of the range of average conversation referred to previously.

It is seen from Fig. 4 that the intelligibility begins to fall off rather sharply at about 57-db noise level with speech at 60 db and at about 65-db noise level with speech at 70 db. Also, for the projector under test (Fig. 3), the signal-to-noise ratio is substantially constant; in other words, noise frequency is not an important consideration. If speech level is taken at an average of 65 db, it may be concluded that for the projector tested, the intelligibility begins to fall off rather sharply at 61 db.

Table I. Data for Plotting Curves Shown in Fig. 4.

Articulation index	Intelligibility (% sentences understood)	$B_s - B$ (db above 10^{-16}w/sq cm)
0.2	70	0
0.3	93	3
0.4	96	6
0.5	97	9
0.6	97.6	12
0.7	98.2	15
0.8	98.8	18
0.9	99.4	21
1.0	100	24

The Empirical Approach

To verify the results of the analytical approach, an experiment was designed to answer these questions: Does projector noise interfere with a student's ability to absorb the information presented in a training film? If so, to what degree?

This approach involved showing three training films (F_1, F_2, F_3) at three different levels of projector noise (55, 60 and 65 db) to each of three typical Service classes (A, B, C) giving knowledge tests before and after showing the films, and computing by statistical techniques the effect of projector noise on amount of knowledge absorbed under the various

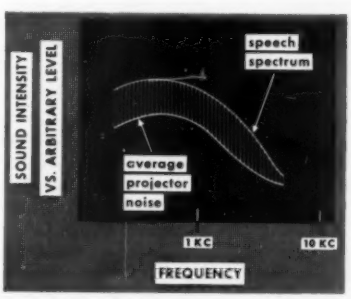


Fig. 3. Comparison of projector noise spectrum with typical speech spectrum.

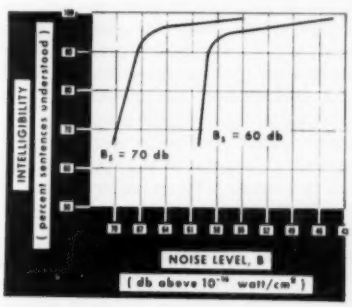
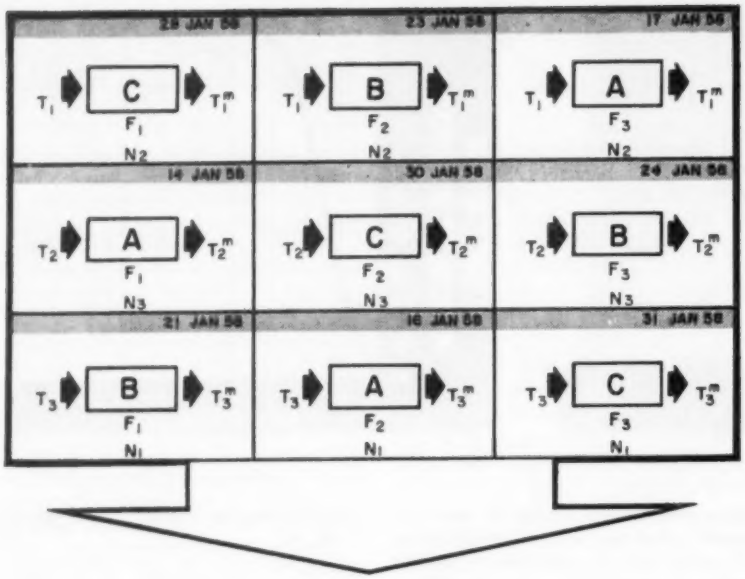


Fig. 4. Noise level vs. intelligibility with speech at 60 and 70 db.



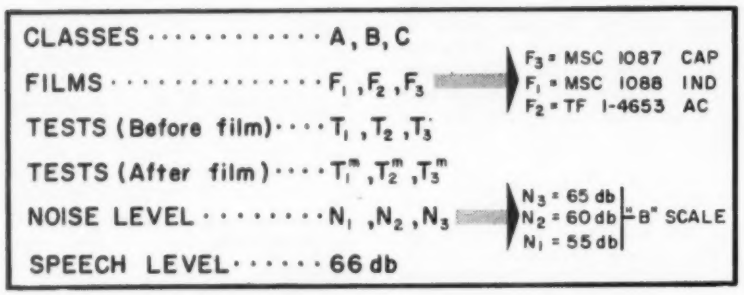

CLASSES · · · · · · · · · · · · A, B, C
FILMS · · · · · · · · · · · · · · F1, F2, F3
F3 = MSC 1087 CAP
F1 = MSC 1088 IND
F2 = TF 1-4653 AC
TESTS (Before film) · · · · T1, T2, T3
TESTS (After film) · · · · T1m, T2m, T3m
NOISE LEVEL · · · · · · · · N1, N2, N3
N3 = 65 db
N2 = 60 db
N1 = 55 db
B" SCALE
SPEECH LEVEL · · · · · · 66 db

Fig. 5A. Experiment design, empirical approach.

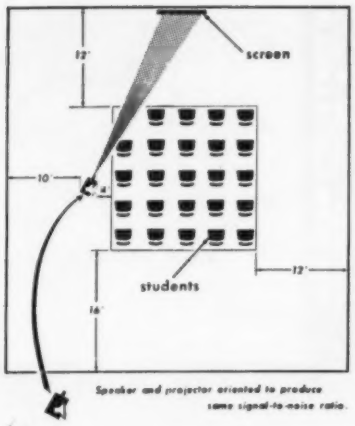


Fig. 5B. Experiment design, classroom arrangement.

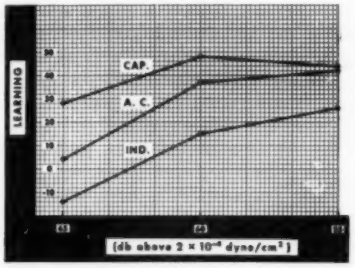


Fig. 6. Test arrangement: learning vs. noise level for three films, signal-to-noise ratio constant (note Fig. 5B).

conditions of test. Figure 5A shows the factors involved in the experiment.

This approach required the establishment of three different levels of projector noise and one level of speech. Sound-pressure levels were measured with the meter, described in the appendix, the units of the readings being decibels above 2×10^{-4} dyne/sq cm. The meter panel switch was set on weighting position B to approximate the response of the ear to pure tones referred to a 70-db level at 1000 cycles.

With the Bell & Howell 16mm projector as the noise source, means were devised to run tests with projector noise levels of 55, 60 and 65 db. To obtain a 55-db level, the projector was enclosed in a padded box; the 60-db level was obtained with the projector operating under normal conditions; and to get the 65-db level, the side door of the projector was left open. The sound level of the amplified film soundtrack was adjusted to 66 db by previously placing the loudspeaker in a room remote from the projector noise and adjusting the amplifier. In order to obtain the same signal-to-noise ratio over the entire class, the speaker and the projector were placed at the same location; not an ideal situation but perfectly suitable for purposes of testing (Fig. 5B).

In all these measurements the sound-level meter was placed 5 ft from the source of noise or speech. Before starting, a measurement of the ambient noise was taken and it was found to be 34 db referred to 2×10^{-4} dyne/sq cm. This was considered negligible and was disregarded.

Each class consisted of 24 students and a total of 9 classes was investigated. A 10-question multiple-choice test on the film subject was given before each showing and a different 10-question test after the showing. The tests were graded on a percentage basis. "Before" and "after" scores of each student on each of the nine runs are given in Table II.

It will be noted that Table II shows that a few students made lower "Post" than "Pre" scores, apparently representing loss of learning. Although no explanation of this phenomenon is immediately apparent, it introduced no error in the results indicated by Fig. 6 since it was found that the shapes of the curves remain the same if all the negative values are ignored in computing learning.

The variables that are considered are projector noise level, training films and groups (or classes) of students. The films constitute a complex variable (length, content, quality of verbal and visual presentation, etc.) and the personnel viewing the films constitute an even more complex variable (intelligence, aptitudes, interests, etc.). In this discussion no attempt will be made to isolate and consider the components of these variables, but the general effect of the variables will be evaluated.

The average scores made by each class on the tests are given in Table II. These are converted to a more meaningful form and listed in Table III. Here each entry is considered to be a measure of how much the class learned as a result of viewing a particular film under specific noise conditions. The entries were obtained by the relation:

$$\text{Learning} = \frac{\text{Increase of knowledge}}{\text{Maximum possible increase}} = \frac{b - a}{1 - a}$$

where a is the score in per cent correct on the test given before the film was viewed, and b is the score in per cent correct on the test given after the film was shown.

It is of interest to determine the statistical significance of the three vari-

Table II. Scores on Tests Given Student Classes A, B and C Before and After Viewing Three Films at Three Different Noise Levels.

Noise level, 55 db						Noise level, 60 db						Noise level, 65 db					
Class B Film F_1		Class A Film F_2		Class C Film F_3		Class C Film F_1		Class B Film F_2		Class A Film F_3		Class A Film F_1		Class C Film F_2		Class B Film F_3	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
—	—	10	50	60	70	30	50	20	40	70	90	60	55	70	80	85	50
60	60	50	80	55	70	50	90	40	60	80	80	60	77	70	70	70	70
40	80	80	100	40	60	20	40	50	70	80	90	40	44	50	60	80	60
30	60	—	—	70	50	30	70	10	50	70	70	30	55	60	60	40	50
50	70	90	100	80	70	50	80	20	70	90	70	40	77	50	70	100	80
40	40	40	80	50	60	50	90	50	30	80	60	40	55	50	70	70	70
40	30	40	70	50	90	50	70	40	60	60	50	70	99	60	40	80	80
20	80	20	40	60	90	10	40	40	100	40	90	40	88	50	30	20	80
30	80	40	60	80	90	40	90	50	90	50	70	70	66	50	40	80	90
40	80	30	60	80	100	50	60	50	70	90	80	50	55	50	60	80	70
50	80	30	70	75	60	30	60	60	50	80	80	60	55	50	50	90	80
40	70	40	90	90	80	40	80	20	30	40	80	60	55	40	40	90	70
50	70	20	50	85	60	40	70	40	30	90	50	40	55	50	60	45	30
40	90	50	60	70	90	60	40	30	40	50	60	30	55	80	70	80	80
50	80	30	60	80	90	40	60	40	70	70	70	70	66	60	60	70	70
30	20	60	80	90	50	30	90	50	40	50	60	50	55	40	20	70	80
30	80	50	90	65	70	30	90	—	—	70	60	30	55	40	70	100	70
30	60	40	60	70	90	40	60	50	60	45	80	50	66	60	40	80	70
50	80	20	80	60	80	40	50	20	80	60	70	50	55	70	80	70	60
60	60	60	70	80	90	40	90	30	90			60	77	50	70	80	100
		50	60	60	80	30	70	60	90			70	77			50	60
		10	20	90	90	40	60	70	90			90	88			45	50
		10	10	80	80			40	70			40	99			80	40
				40	90			60	60			70	88				
* 41	67	40	65	69	77	38	68	41	63	67	72	54	67	55	57	72	68

* Averages

Table III. "Learning" at Three Different Noise Levels. (Student Groups A, B and C; Films F_1, F_2 and F_3)

Noise level, 55 db			Noise level, 60 db			Noise level, 65 db		
Class C Film F_3	Class A Film F_2	Class B Film F_1	Class A Film F_3	Class B Film F_2	Class C Film F_1	Class B Film F_3	Class C Film F_2	Class A Film F_1
44	42	26	48	37	15	28	4	−14

ables—projector noise level, films and groups — in so far as their effect on learning is concerned. Variance analysis[7] provides a convenient method of attack. Table IV is a Latin Square arrangement for the three variables. Rows correspond to the three noise levels, columns correspond to the three films, and entries in the nine boxes are values of learning that correspond to the three groups (also see Fig. 5A). The variance of all the average values is determined, and the variance of each of the variables is portioned out of the totals. Then the variance of each of the variables is compared with the variance of the experimental error. Since these ratios have an F-type distribution, the statistical significance of the variance of each of the variables is then determined from an F-distribution table according to the degrees of freedom in the numerator and denominator of each ratio. The results of these computations appear in Table V.

The significance of the effects that these three variables have on learning is determined by comparing the computed F ratios (Table V) with the 1 and 5% values for two degrees of freedom as given in a standard F-distribution table. These values are 19.30 (5%) and 99.30 (1%). F ratios below 19.30 are of no significance; values from 19.30 to 99.30 range from little significance to great significance; values above 99.30 are very highly significant. On this basis, "films" and "noise level" are seen to be of moderate significance, and "groups" are of no significance. This latter was to be expected since any differences among the groups in respect to prior knowledge were removed by making the measure of learning for each student not simply the difference between the two tests but this difference taken with respect to the student's maximum possible learning.

The effect that noise level and films have on learning can be seen from the curves in Fig. 6. The ordinate of each plotted point (average learning from Table III) is a function of three variables, "films," "noise" and "groups." Since it has been shown that the latter has no significant effect on learning, the three plots fairly represent the effect of noise level and films. It is seen that the capacitance film F_3 induced the most learning, the A.C. film F_2 somewhat less, and the inductance film F_1 the least. Except for the fall-off of the capacitance

Table IV. Latin Square Arrangement for the Three Variables: Noise Level, Films and Student Groups A, B, C (also see Fig. 5A).

	F_1 Ind.	F_2 A.C.	F_3 Cap.	Totals
65 db	C	B	A	
	−14	4	28	18
60 db	A	C	B	
	15	37	48	100
55 db	B	A	C	
	26	42	44	112
Totals	27	83	120	230

Table V. Analysis of Variance of the Three Variables: Noise Level, Films and Student Groups A, B, C.

Source of variation	D.F.	Sum of squares	Mean squares	F ratio	Level of significance
Noise level	2	1745	873	31	0.04
Films	2	1461	731	26	0.05
Groups	2	131	66	2	Not significant
Exper. error	2	55	28		
Totals	8	3392			

curve at 55 db, the three curves are very similar in shape. Discounting this difference as the result of an error in the experiment (for example, the quiz may have been of greater than average difficulty), it is seen that the rate of learning drops rather sharply as the noise level rises above 60 db, and that a decrease in noise level below about 60 db produces only a small improvement in learning.

Conclusions

The analytical approach provides a general method for determining the articulation index with a particular projector noise and a given speech level. Figure 4 shows that intelligibility (and, consequently, learning) begins to fall off rather sharply at an articulation index of 0.4. Therefore projector noise must not result in an articulation index below this value.

As was seen from the example given in this approach, the determination of the articulation index is much simplified if the noise spectrum of the projector parallels the spectrum for ordinary speech — that is, if it peaks around 500 cycles (Fig. 3). In such a case frequency is not an important factor and projector noise can be measured with a standard sound-level meter using the B weighting network. Moreover, projector noise must not exceed 61 db with speech level at 65 db (both measured at a distance of 3 ft from source).

The empirical approach shows the effect of noise on learning as measured under real conditions. Figure 6 shows that learning begins to fall off rapidly at noise levels above about 60 db measured at 5 ft with speech level of 66 db also measured at 5 ft; this is approximately equivalent to 60 db noise and 67 db speech measured at 3 ft. Although in reaching this conclusion certain assumptions were made and a number of interrelated variables were involved, it is believed that the result substantiates the figure of 61 db, which we conclude from the analytical approach is the maximum permissible noise level under the stated conditions (both noise and speech measured at 3 ft, level of speech 65 db).

It should be understood that in the analytical approach the relationship between learning and noise rests upon the empirical curve (Fig. 4) which is, by and large, an index of ability to hear above noise and does not involve such factors as fatigue or apathy, which may be operating in the empirical approach.

This study demonstrated that the projectors furnished for test produce signal-to-noise ratios and articulation indexes that are substantially independent of frequency. But the study does not assure that other projectors would produce noise of a similar character. Others might have noise spectra that peak at frequencies well above or below the peak for normal speech (500 cycles), in which case the method of measuring noise would become more involved.

APPENDIX

Measurement Procedures

Sound-level measurements were made on two projectors — a Bell & Howell 16mm (JAN/AQ-2A) and a Viewlex Inc., 35mm slide projector (PH-222C) having no provision for synchronized sound (the curve for the JAN projector only is reproduced).

The sound-level meter was a General Radio Type 1551-A which measures sound-pressure level at the microphone. Sound-level range is from 24 to 140 db (above 2×10^{-4} dyne/sq cm). The meter has an output of 1 volt across 20,000 ohms (when the panel meter is at full scale) which can be used to drive a frequency analyzer.

Also employed was a model 300A Hewlett-Packard harmonic wave analyzer, which is a frequency selective heterodyne voltmeter designed for use over the range 30 to 16,000 cycles.

The projector was located in the center of an anechoic chamber with the sound-level meter placed 3 ft in front of it, and the projector was operated in a normal manner. It had previously been determined for this particular projector that the noise level was substantially uniform when measured in a horizontal plane at 45° intervals around the projector. The meter panel switch was set on weighting position C which provides uniform response to all frequencies within the range of the microphone. The 1-v reference signal of the sound-level meter was applied to the wave analyzer, which was located outside the chamber. The output of the analyzer was in the order of millivolts.

Readings were taken in the spectrum 250 to 7000 cycles, one in each of 20 bands. The frequency bands used were those already calculated by French and Steinberg,[1] the frequency limits being such that the ΔA_m of each band was 0.05, i.e., one-twentieth of the articulation index of the full range under optimum conditions. The measurement in each band was made by setting the wave analyzer at the geometric mean of the band's frequency limits. The bandwidth over which the analyzer was operated was 290 cycles, which was somewhat broader than some and narrower than other bands to be measured. The maximum difference between analyzer bandwidth and frequency bands to be measured was +990, −160 cycles. Curves of decibels vs. frequency were plotted for each projector according to the relation

$$\text{db} = 20 \log \frac{a}{b}$$

where a is the analyzer reading (volts) and b is the reference signal (1 v). The ordinates are plotted as positive values better to illustrate the relative sound levels over the frequency range (Fig. 1).

References

1. N. R. French and J. C. Steinberg, "Factors Governing the Intelligibility of Speech Sounds," *J. Acoust. Soc. Am., 19:* 90–119, Jan. 1947.
2. *Reference Data for Radio Engineers*, 4th ed., International Telephone & Telegraph Corp., New York, 1956.
3. *Radiotron Designer's Handbook*, ed. by F. Langford-Smith, 4th ed., Radio Corp. of America, Harrison, N.J., 1953.
4. M. Y. Colby, *Sound Waves and Acoustics*, Henry Holt & Co., New York, 1938.
5. *Handbook of Noise Measurement and Measurement of Vibration*, 3rd ed., General Radio Corp., West Concord, Mass., 1956.
6. S. S. Stevens, J. P. Eagan, and G. A. Miller, "Methods of Measuring Speech Spectra," *J. Acoust. Soc. Am., 19:* 771–780, Sept. 1947.
7. C. E. Weatherburn, *Mathematical Statistics*, University Press, Cambridge, Mass., 1947.

Edit. Note: Subsequent issues of the *Journal* will contain additional papers on audio-visual and nontheatrical film subjects. The July *Journal* is expected to include a paper which, for production reasons, could not be scheduled in this issue:

"A Study of Factors Influencing the Legibility of Televised Characters" by Warren F. Seibert, Duane F. Kasten and James R. Potter, Audio-Visual Center, Purdue University, Lafayette, Ind.

The Soundtrack in Nontheatrical Motion Pictures

By FRANK LEWIN

The functions of the three components of the soundtrack—voice, music, sound effects—are delineated in Part I. In Part II the editing of the components is considered in detail. Preparation of the work print and sound tracks for re-recording is described in Part III. The re-recording (mix) is discussed in Part IV. **See Notes on p. 412.**

PART II — EDITING THE COMPONENT PARTS OF THE SOUNDTRACK

The editing of the soundtrack is discussed as it relates to the overall production of the film. Techniques are suggested for screening the component tracks in interlock prior to the re-recording. Methods employed in editing voice, music and sound effects are described in detail, including the laying out of tracks for maximum control at the re-recording.

Soundtracks in nontheatrical films range in complexity from a simple narration with, possibly, introductory title music and concluding music, to an intricate combination of narration, dialogue, music and sound effects. All soundtracks have in common the fact that their component elements must be edited separately, mounted on reels running synchronously with an edited work print made from the film's negative or original, and finally are re-recorded (mixed) to be combined into a single track. Before the introduction of magnetic tape and the adoption of magnetic film, all sound tracks consisted of positive film, and the final mixing was done direct to negative. Compared with today's tape techniques the process was more time consuming, frequently less satisfactory technically and certainly more expensive.

In the overall production of a film the soundtrack often suffers a relative neglect. It represents one of the last steps before the film is printed; as a result it falls heir to all the delays accumulating in the course of shooting and editing. Little time is allotted to its completion, even under ideal conditions, and frequently not much more consideration is accorded it than getting the narration and "some background music" put together.

Partly because the advent of tape has made the creation of a truly interesting soundtrack very much more easily accomplished, this attitude of allowing a minimum of time for the editing of the sound is fast disappearing. It is patently incongruous to spend weeks and often months on the editing of the picture, then devote a few days to that part of the film which gives it the right to be called a *sound* motion picture. However, it is still common practice to screen the silent work picture innumerable times — yet to permit the sound tracks to arrive at a re-recording session without once having heard them under good conditions in conjunction with the picture. Another aspect of this practice consists of booking a mixing date before the tracks have been recorded (in the case of voice and original musical scores) or completely edited, trusting that all the elements will be properly assembled by the time the mix is scheduled. The amount of time booked for the re-recording is generally determined in advance, frequently with little regard to how much work must be accomplished in the allotted session. The result? At the mix either a compromise — settling for the half-realized and a track that almost-but-not-quite comes off — or surprises and recriminations.

It is wasteful, and certainly not conducive to arriving at an effective sound track, to expect that the mix serve both as first screening and final re-recording session. Even the simplest track should be screened on a good sound system at least once before it is incorporated in the film.

The argument is often advanced, mostly in the case of 16mm films, that quality cannot be maintained in the release prints, especially under frequently inadequate projection facilities in the field; that consequently it does not pay to be too particular with the soundtrack. Actually the reverse attitude should prevail: if quality is really lost in the final product, how much more important is it to make the original track as good as possible! Something at least will remain audible, and possibly impressive, once the alleged deteriorations set in. With many nontheatrical films finding secondary audiences on television it becomes important to transcend the merely technical and intramural in a business film, and that means making it more dramatic, exciting, in other words more entertaining. Variety in the soundtrack can be of tremendous help to achieve this aim — but enough time must be allowed to enable the editors to do the job well.

Even under favorable conditions the time allowed for editing the soundtrack will be limited. The mere fact that this *is* one of the last steps in the production makes for pressure. It is important, therefore, to lay out the individual tracks efficiently so that no technical difficulties prevent the realization of aesthetic considerations.

Voice

It is advisable to keep different elements on separate tracks. Where there is narration (recorded in a studio) as well as sync voice (recorded on the set) it is well to keep the narration on one track and sync voices on another. It is assumed that the narration is recorded under ideal conditions and can, consequently, be re-recorded as is, once the proper level has been established. This is not always the case with sound recorded on a set where the conditions necessary for shooting a picture often override efforts to obtain good sound: voices may need differing equalizations, noise may have to be filtered out, levels may vary (especially where more than one set or location is involved or shooting is done on different days). By keeping the sound on a separate channel the mixer has control over it. If, on the contrary, narration and sync sound are cut into the same track, constant changes of equalization and level settings, back and forth, may become necessary. The result of such a layout of tracks is that the mixer can devote less of his attention to the other elements (music and effects) which often require his ministrations at precisely these transition points.

Giving the mixer separate control over sounds of different character or technical condition is, in effect, the key to an intelligent layout of the tracks.

It is important that the narration track be recorded under perfect studio conditions. If a voice is to maintain clarity and intelligibility more is required than that it merely sounds louder than music or effects. It must be incisive technically as well as in delivery. The recording engineer can see to it that it has sufficient "snap," that it is live without being echo-y or boomy, that its sibilants are well controlled, and that no unwanted background sound finds its way into the recording. This last point is of especial importance: a voice track competently recorded will be so clean that pauses in the narration will seem absolutely silent. Frequently music or effects are requested in a film for no other reason than that they should "cover up" defects in the voice track. Occasional background noises in a voice track can, of course, be covered up by music or effects, but as a working hypothesis for an entire film the procedure is obviously absurd.

Music

One or two tracks are generally sufficient to lay out the music. The use of two tracks may be made necessary by overlapping two sections of music; another reason may be to enable the mixer to compensate for differences in level or equalization between two adjoining portions of music.

The availability of a second music track gives the mixer complete control in the case of close interaction between voice and music. For example: a piece of music is intended to remain at full level until just before the voice enters; one part of the music can run right up to the start of the voice without spilling into it; the continuation of the music is placed on the second track. The mixer need not dial down the music at all in this case and need concern himself only with keeping the second track low enough to be comfortable when it enters under voice. The reverse is equally effective: an accent which is to enter on cue after a word may be preset on a separate track to hit loud without tripping on the voice. In either case the mechanical adjustment which would have been necessary had the music been on one track is avoided — besides being relatively safe in execution the result is generally more effective.

The use of two tracks permits the music editor to perpetrate superimpositions of similar or dissimilar sections of music. It is often possible to heighten the excitement of a climax (especially if the track itself is somewhat deficient in power) by superimposing a cymbal or gong hit, or a thump on a drum. In order to simulate the effect of an echo it is possible to stagger two identical sections of music a frame (or more) apart on two tracks. This method of obtaining an echo effect may also be applied to voice (spoken or sung).

Superimpositions

The superimposition of a musical (or sound) effect can sometimes be employed to obscure a slight defect in one of the music tracks, or add an accent which does not exist in the music at that particular spot. In the case of loud music, a gong synchronized on the other track to hit a frame or two ahead of a slightly defective cut, for example, will do the job. In the case of soft music, a bell note will do it. Where the pitch of the superimposed accent (bell note, piano chord, celeste arpeggio) may create a problem of tonality in the context of the music, a triangle ping will make a good substitute. Carried out with discrimination the practice of superimposition can spice up a music track through relatively simple means; abused, it may effectively ruin a musical score.

Where the music editor has control over the sound-effects track he can often successfully cover slight defects in the music track by putting a sound appropriate to the scene at the point in question, which will either mask the spot or divert the listener's attention momentarily. A gun shot will always work, of course; for more peaceful situations, however, such sounds as car horns, train whistles, chair squeaks, coughs, door closings, or any convenient animal sound will do. It is preferable, especially in the case of nonexplosive sounds, to place the effect about eight frames ahead of the flaw. The process of masking through diverting the listener's attention by a momentary effect may also be used to good advantage where a defect exists in the voice track which cannot be eliminated by editing or filtering it out.

The A and B Technique

For the use of library music two tracks used to be indispensable. In its crassest form the use of two tracks enabled the editor to lay overlapping selections against the scenes, which could be dialed in or out at will and crossfaded into each other whenever expedient. This A and B technique has, happily, progressed from these barbaric antecedents; applied with a modicum of taste and competence it works well for simple soundtracks. Once a piece of music has been selected, it is laid into one track (let us call this track "Music A") at the beginning of a sequence. From a point where the music is to end (or change into another selection) it is backed up on the other ("Music B") track, creating an overlap. At some time during the overlap, preferably under voice, "Music A" is crossfaded into "Music B." The next sequence is treated in similar fashion until the whole film (or section of film) is "covered" with music.

It is not necessary (although it is preferable) that a number start at its beginning, nor need it end at its finish. When, however, the number is started in the middle it should have a good musical entrance. This may be accomplished by

(a) Fading into a long sustained chord at the beginning of a phrase.

(b) Crossfading out of a similar number, preferably on sustained chords; or crossfading out of an active section into another active section; or, ideally, crossfading between sections of indefinite character (very active and very muddy harmonically). Crossfading is also effective from a quiet section into an active section; it is rarely effective from an active into a quiet section.

(c) Starting clean on any section that has a natural pause ahead of it.

It is difficult to start clean by cutting into a section that does not have natural holes. Merely chopping at the beginning of a phrase creates problems at the re-recording, especially if the entrance is not under voice. To prevent the music from "popping" in, it sometimes works to take a few sprocket holes' length of tape from the very start of a number (not necessarily the same number) and splice it ahead of the chopped phrase. This artificially supplies the attack which generally precedes the actual sound of a piece of music (the swish of the bow with which strings are set in motion; the breath necessary for voices or wind instruments to produce a tone; the impact which is characteristic of percussion sounds; the ictus of a bell). In loud orchestral passages the missing attack may be supplied by using the first frame off a drum hit. If all else fails, the music should be retransferred with a clean fade-in at the desired point. Leaving this fading in to be done at the re-recording may result in delays until the proper effect is achieved after several run-throughs.

How a piece of music is gotten out of is just as important as how it is entered. A piece or phrase that is to end clean needs a certain amount of dying out or reverberation. If this is missing, the number can be faded out on a sufficiently long sustained chord, in duration at least the length of a measure in the tempo of the number, preferably a measure and a half (or more) which would correspond to a hold (fermata) at the end of a section of music. If another piece of music follows immediately there is not quite such a technical problem. The other piece, on a separate track, will generally put a satisfactory conclusion to the outgoing phrase. For greatest effectiveness, the incoming piece should have a strong beginning. It is important, however, to make the transition musical, i.e. to bring the next piece in on a beat corresponding to the rhythm of the outgoing piece. The question of rhythm, or even of a logical musical segue, may be disregarded somewhat when the entrance makes for a strong change in character, especially if it accompanies a change in the picture. Again, it is generally more effective to go from a weaker (softer) into a stronger (louder) piece, rather than the other way around. In all transitions of this kind an overlap of some length must exist — it may be as little as one or two frames in fast-moving pieces. There must never be a hole between the end of the music on Track A and the start on Track B.

Making certain that a piece of music be in character with a sequence and laying it in so as to cover it will, of course, suffice only for the most elementary kind of soundtrack in which the music does no more than supply a background to the voice. Once a selection has started, it will contain salient features

which may be exploited to emphasize narration or picture, or both. As these musical comments only in rare instances happen to hit where they would do some good it becomes necessary to make them fall where the editor wants them to. The A and B technique could conceivably be used, but it will prove increasingly cumbersome where an expressive, and consequently flexible, music track is demanded.

The music must then be cut.

Cutting Music

It is quite simple to cut music without in the least doing violence to proper musical syntax. This fact may seem disturbing to musicians, but it is easily explained by the difference between the structure of a piece of concert music and one that follows the vagaries of the film. This basic difference also explains why music which has pronounced formal character (square phrases, rigid cadences, flamboyant concert endings) often lends itself but uneasily for use with films; it may also, it is hoped, discourage composers from writing a score for a film with an eye to the suite they will extract eventually for performance in the concert hall. The freer rhythmically, harmonically and, above all, structurally music is, the more valuable its contribution to the sound track.

When making a cut, consideration of proper harmonic progression may largely be disregarded; it is equally unnecessary to preserve strict metric logic in the rhythm. When cutting music it is advisable to regard it as a piece of sound and observe the considerations governing the technically smooth juncture of any two sounds. This does not mean, however, that the editor can ever lose sight (or hearing) of the fact that he is dealing with music. While much can be done, not everything goes: the only test of whether a cut works consists of listening to it objectively — if it sounds right it works. The taste of the editor, naturally, will determine what is considered "right" — the range may be quite wide — and herein lies the difference between the work of a mechanic and that of an artist.

A cut in the music (unless effected to excise a technical flaw) is made in order to move something from where it happens to fall to a point where it is desired that it hit. Depending on the particular instance any of the means of music cutting described below may be employed — sometimes in combination. A cut within a section by its very nature means that the music is shortened. Consequently the following possibilities are all concerned with making a point within a section of music hit earlier — if it is to fall later the section must first be lengthened, possibly by intercutting with another copy of the same selection, so that the point in question falls *later* than desired. By pulling it up it can now be placed wherever it should hit. It need not be pointed out that these considerations apply as well to intercutting between different sections (or selections).

Following are suggested ways of cutting music, listed in the order of ease of execution:

(a) before sharp accents;

(b) at the start of well-defined musical sections;

(c) in the course of a pronouncedly rhythmic section;

(d) within rhythmically inactive sections of similar orchestration; and

(e) within tones or chords whose level is constant.

(*a*) *Cutting Before a Sharp Accent or Impact*

A heavy chord, stinger chord, or percussion beat may easily be joined to a different section or selection of music. It is a generally observable fact in cutting any sound that the change from soft to loud, unless the difference of levels is excessive, will pass technical muster easily. The reverse is rarely the case, and is excusable only when a sharp drop in intensity is actually called for — mostly with sound effects (on changes of perspective, for instance); in music the impression will be that of a distinct technical flaw. Care must be exercised when a sharp accent is pulled back into a strongly rhythmic section — the rhythm of the music, especially if fast, cannot be disregarded. The accent in such a case ought to fall where the beat of the music would make it seem natural. Few things will make a cut sound so obvious as placing a strong accent on what in the normal course of the music would correspond to a weak beat or, worse still, between beats. It does no good in such a case to assume a phony kind of syncopation where none is perceived by the ear. The slower the pulse of a selection, the easier such a cut becomes; in very slow music it may be placed almost anywhere past the point where a chord in the basic beat has been established. In music which has no rhythmic life at all there is no problem, of course.

When cutting ahead of a strong beat it is important to cut right up to the start of the sound. Even one sprocket hole of silence ahead of such an impact will be noticeable, especially if in the completed juxtaposition the music preceding the cut is loud. Equal care must be given the outgoing music ahead of the cut — there must not be audible even a whisper of the cut off beat, otherwise a noticeable "chip" will sound at the joint. In no case should any dead leader or room tone be inserted at the cut, possibly for the purpose of eking out a reluctant rhythm. (The only situation in which such a procedure might be condoned is when it is known that another element of the track — voice or sound effect — distracts the attention at exactly the same moment. It is a risky expedient, at best.)

(*b*) *Cutting at the Start of a Well-Defined Section of Music*

The start of a phrase represents a good point at which to cut into the music. Where it is to be joined to the end of an outgoing phrase there exists little problem, especially within the course of the same number: orchestration, rhythm and key will generally match and the change should pass completely unnoticed. It is coincidence, naturally, when phrases end and start so conveniently. Consequently the outgoing section must be brought to the desired position so that a phrase ends at the point where the new phrase is to be joined. This may be accomplished by making another cut, or possibly a series of cuts, *within* the preceding phrase so as to reduce it to the desired length. However, it is not always absolutely necessary to conclude a phrase before it is cut to the start of a new one: making the cut in the middle of the outgoing phrase, preferably on a strong beat, will result in an elision which most of the time makes sense musically and is, for that reason, perfectly acceptable. Following the axiom that it is effective to cut from the less impressive to the more impressive — soft to loud, nonrhythmic to rhythmic, slow tempo to fast tempo — any cut that represents a heightening of intensity, level or rhythm is likely to be successful. Any transition out of a vague musical statement (confused or no rhythm, a harmonically neutral passage) into the definite start of a phrase generally works well. Finally, it may be said that any phrase which starts with what may be described as a musical effect — a sweeping figure, a trill, a prominent percussion roll or flourish — may be cut with impunity into almost any beat preceding it, especially if this musical effect represents an arhythmical point in the music.

(*c*) *Cutting in the Course of a Pronouncedly Rhythmic Section*

Making a cut by eliminating part of a rhythmic passage represents an effective means of shortening a section. Proper attention must be given not to upset a strongly established rhythmic pattern, although it is surprising how much the ear accepts in this respect. Generally the lower the complexity of the rhythm — reaching rock bottom in the steady beat of a march — the more care must be given to observe the basic beat. In a complex rhythm, especially if it coincides with massive orchestration and great harmonic activity, a cut may be made almost anywhere; if in addition the rhythm runs quite fast almost anything goes. A warning must again be sounded against cutting counter to the judgment of what the ear perceives as just. Only the first impression counts: a cut that needs to be explained simply does not work in practice.

The abrupt juxtaposition of differing tempos may require some work to make a cut smooth. A change from slow to fast

may be effective, especially if it coincides with a corresponding change in the image. It is often advisable to create an artificial speeding up of the slower, outgoing, music by shortening the distance between beats for a measure or so before the cut. This is effected by cutting out a frame or so ahead of each beat. It may prove preferable to execute this speeding up gradually: lifting out, for example, three sprocket holes in the penultimate measure before the cut, six sprocket holes in the one immediately preceding the cut. Changing the rhythm of the music may sometimes be required to match an action on the screen, such as marching feet. For short periods of time the track can be brought into sync by thus shortening beats. Where this process would lead to an extensive editing job, and time or inclination do not permit, it might be advisable to have the number retransferred at a faster tempo. (This usually means a change in pitch, of course, unless a recently invented device* is utilized which slows down or speeds up $\frac{1}{4}$-in. tape without altering the pitch.) The change from fast to slow rhythm is rarely effective unless the speed of the incoming track is similarly modified.

(d) Cutting Within Rhythmically Inactive Music

The less definite an attack the music has, the more difficulties stand in the way of a clean cut. The prime aim must here be to find matching levels in the adjoining sections. Another hint towards a successful joint is provided by identical or similar fullness and character of orchestration. The louder the music, the easier will it be to make a smooth cut — even to the extent of disregarding matching orchestral timbres. In quiet passages, however, it is often necessary to experiment until, somewhere in the course of a chord, the levels are found to match. In music that moves very slowly this process is facilitated by the phenomenon that a sizable portion of a chord may be excised without disturbing the basic rhythmic movement. It will also be found that a chord does not sustain an even level of sound during its entire length: it generally rises from a soft start to full level. By "chipping" away at its start, testing the joint by splicing it at these progressive points to the outgoing section of music, a point will be discovered at which the cut sounds smooth, i.e. the levels match. The adjustment may also have to be made on the piece ahead of the cut, catching a dying-out sound at a point where it is still loud enough to make a smooth joint with the incoming sound. The danger in this process lies in often destroying the attack characteristic of wind instruments; it is thus a procedure adaptable principally to music in which strings predominate or in which the orchestral sound is so full that no wind instruments stand out clearly. Careful attention must be paid also to instruments which are subordinate in the orchestral scheme — generally those sounding the bass of the harmony, either sustained or intermittent (low drum rolls, double bass pizzicato notes, organ pedal notes). When there is an audible bass sounding ahead of the cut, yet none is perceptible in the orchestration past the cut, the result will be quite noticeable and rarely acceptable.

These fine points may be partially disregarded when the cut occurs under voice or where sound effects are running which can obscure slight imperfections in the music track. However, it is wise to plan and edit a music track so that it constitutes a perfect technical entity, capable of standing by itself without apology. For one thing, voices may be shifted and effects eliminated at some time after the music has been edited; for another, a foreign version or future re-editing of the film is likely to disturb the juxtaposition of voice, music and effects and thus bare previously concealed defects.

(e) Cutting Within a Tone or Chord

A cut within a sustained tone or chord is possible under certain conditions. A cut of this kind does not lend itself to experimentation as readily as the methods described above. In the conditions enumerated under (a) to (d) it is possible to effect the splice, test the sound of the cut, and — if found wanting — replace the pieces without audibly affecting the sound track; in the case of sustained tones, however, a cut once made can often not be spliced together again: a faint pop or interruption of sound may occur. The less complex the nature of the sound the harder is it to splice it. A pure tone, siren, a French horn note or a bell tone, for example, can only quite rarely be tampered with successfully. As the sound increases in complexity (string note with vibrato, trumpet note, human voice, fog horn) it becomes increasingly a question of finding the points at which levels match. When the level seems to match yet the cut still "pops" slightly it may pay to eliminate one or two sprocket holes on either side of the cut. This procedure frequently reestablishes the equilibrium of the "beat," the frequency of vibration. When sound becomes very complex, and especially when the level of sound is quite high (full orchestra chord, preferably with percussion; human voices combined, as in a chorus; klaxon) it is exclusively a question of matching the level on either side of the cut in order to make a perfect joint.

The application of the methods of making musical cuts described above rests, of course, with the discretion of the sound editor. Frequently a combination of several cuts will achieve the desired result. However, as with most successful things on a soundtrack, this result bears little relation to the amount of technical work that has gone into its creation. A musical score for a film must sound completely effortless — however many cuts and transitions were necessary to achieve the final product.

How Much to Expect From a Musical Score

The editor, in cooperation with director and producer (and the composer where one is involved) must be clear from the outset what a particular section of music is supposed to do. The most direct means is always preferable. The primary task in editing music to a scene is to find a good beginning and end, determine the music's outstanding accents, observe its climax or high points and endeavor to match them, where required, to the image. When the music fits well and has been made to hit those points of the scene that are deemed important for musical treatment it is often wise to let well enough alone. Trying to make the music hit every cut, punch all actions and still fit in mood is technically possible; it is frequently, however, quite unnecessary. The overall effect is easily scattered through an obsession with details, and this temptation is always present when working in a medium as pliable as the motion picture. Just as at *some* point in the editing of the picture somebody has to say "when," so in the cutting of music the line between refinement and fussiness must not be crossed.

One must not expect too little of a musical soundtrack, on the other hand. Technical considerations should never dictate the aesthetic aspect of the music. This means, for example, that if a section of music is a bit short or long to extend throughout a portion of film for which it is intended it should not be left as is, but should be made to conform to the length of the scene by any of the various methods open to the music editor. This may seem so basic a consideration that it should not be accorded the distinction of having it pointed out. The fact that such elementary defects can frequently be observed even in top-quality films, however, may serve as an indication of how little the potentialities of the soundtrack are exploited.

Another aspect of this problem is encountered, especially with library music, when a piece of music changes character (tempo, orchestration, mood) in the course of the number. The temptation is great to lay a selection in and let it ride; when a radical change occurs either before or after a logical change in the picture it is easy to plead pressure of time or less tangible reasons for letting the matter go, and find a rationalization for the failure to do something about it. This makes for

* The TN Tempo Regulator. See New Products Section, p. 432, in the June 1958 *Journal*.

unhappy moments at the mix, especially if the narration does not oblige by hiding the spot.

The above comments apply with equal force to sharp accents in a section of music which near-miss actions in the picture to which they might reasonably be related. Likewise do they apply in cases where characteristic musical accents or changes fall under voice when with a little exercise of ingenuity they could hit between sentences, phrases, and sometimes words. In dramatic films these considerations are indispensable to create an effective cue (whether composed for the scene or taken out of stock); in nontheatrical films such care for details will often help to snap up the pace of an otherwise pedestrian soundtrack.

In library music it is easy to assume that because a piece starts out well in conjunction with a scene (picture or narration, or both) it will continue to do so for the entire duration of the number. One must be constantly on the alert to observe the point at which picture (or narration) parts ways with the music. Similar caution must be observed with pieces whose titles are misleading. Merely because the name fits more or less does not mean that the music is appropriate. The reverse is also true. A number whose title may have nothing to do with the scene in question may fit very well. The ear should be the ultimate judge in all cases.

Screening Prior to Re-recording

The ear must not judge in the abstract, however. It is of paramount importance that none of the intangible points in the music be hamstrung by an incomplete rapport between music editor and producer or director, or the producer's staff on the one hand and his client on the other. The common practice of judging the appositeness of music to a picture purely on the basis of running it on the editing machine, or screening it without hearing the voice track at the same time, should be emphatically discouraged. It takes a great deal of discrimination and experience to visualize (or auralize) the ultimate complexion of the soundtrack by auditioning its components separately. A producer or director should not be expected to evaluate all the ramifications of an intricate soundtrack through a piecemeal presentation or on judgment based on theoretical knowledge or verbal explanations. The alternative is that whoever has to make the decision be shown audibly an approximation of the end result, preferably under conditions where no technical limitations need interfere.

The surest way of judging how well music works for a film is a screening of picture, music *and voice track(s)* at a studio where a competent engineer manipulates the controls. When the added complication of several sound-effects tracks is present, further screenings to demonstrate the compatibility of all the elements to one another may be necessary. These test screenings ought to be taken into account at the time the budget is formulated; they should be an integral part of the production. They will certainly more than pay their way through savings in editing and re-recording time. It is, of course, important that these screenings present the music tracks free from technical defects, laid out so that with a minimum of rehearsal time the true flavor of the track emerges. Some considerations that will help towards achieving this end are described in Part IV devoted to re-recording. They are of equal help in securing a smooth and successful mix.

Sound Effects

Sound effects may be classified into (a) continuous sounds which establish the overall impression of a scene and do not, on the whole, synchronize with action; and (b) isolated sounds which coincide with action in the image. It is well to assign separate tracks to each category; the aim must at all times be to give the mixer absolute control over his synchronized effects with regard to level and desired equalization. He cannot control an effect which forms part of an overall general sound as, naturally, any adjustment of the individual effect will involve the sounds preceding, underneath and following it.

As a sound-effects job increases in complexity more and more tracks may be required, and unless a bit of planning precedes the laying out of the effects the number of tracks may rapidly get out of hand. Even though it is known that only one engineer will be at the controls (in nontheatrical films two or more mixers are the exception rather than the rule) an excessive number of tracks is frequently used, with the result that the re-recording session becomes needlessly complicated. Editors have been known to point with pride to the large number of sound-effects tracks involved in their job as an indication, presumably, to the quality of their work and the stature of the film. Exactly the reverse is true. An editor who can confine a complex sound-effects job to as few tracks as are practicable without forcing the mixer to resort to manual acrobatics will serve his cause best, in time saved and results accomplished.

Where only a few sync effects occur in a film they can often be cut into one of the music tracks which is inactive at that moment. A certain amount of footage free from music must be allowed before and after the effect so that any change of equalization can be done without interfering with the music. When there is the slightest doubt as to the practicability of handling the effect easily, however, the effect should be placed on a track separate from the music. As in nontheatrical films music and *continuous* effects rarely run parallel for any length of time, it is in many cases possible to use one of the music tracks for an occasional overall effect. It is false economy, however, to make a fetish out of reducing the number of tracks to the minimum. Unless there is a compelling reason (limited number of dubbers available, for example) the slightest chance of creating a difficult situation for the mixer should be cause enough to place the effect — even if it is the only effect in the reel — on a separate track. Once the editor is certain that he will need one or more effects tracks he should avoid peppering his music track with effects which might as easily be placed on an effects track. Clarity must at all times prevail in the laying out of tracks, and that generally is best accomplished by keeping the different categories of sound on separate tracks.

At any given moment a number of different sounds may occur: voice, music, effects, and the number of effects can conceivably be augmented by piling one on top of the other. It now becomes a question of how many of these sounds can be made audible *effectively*. A lot of trouble can be avoided by realizing first of all that generally *one* sound must predominate, and secondly by making certain that this sound is clearly heard. Disregarding this rule leads to a confused track which can occasionally be sorted out at the mix through the mechanical boosting of one sound above all others. Frequently, however, the situation can only be salvaged by eliminating one or more elements. It may safely be stated that a good sound-effects job consists very largely of eliminating the unnecessary and concentrating on the important. Sound effects should never be edited without the editor being aware what the narration and music do at the same instant. At many points the music may need to be adjusted (or eliminated) as the effects are edited; close rapport between music and sound-effects editors or, ideally, the editing of the two elements by one man is the prerequisite to an effective end result.

Layout of Effects Tracks

For a fairly active sound-effects job an efficient layout might consist of four tracks; *Effects A* and *Effects B* which carry the sync effects, *Effects C* and *Effects D* which handle the overall sounds. It will rarely be necessary to use more than two sync effects tracks (should, in an extreme case, three effects occur so close together as to require their separation on different tracks, the stray sound can often be put on one of the music tracks — it

is rare that with so many effects clearly audible both music tracks would carry sound at this point); it may sometimes be necessary to have one (rarely more) additional track for the general effects. The reason for this addition might be to enable the mixer to move smoothly from one overall sound to another when these sounds last for only a few feet and crossing back and forth between *Effects C* and *Effects D* would not give him enough time to change equalization, should this be necessary. The additional track can in such a case be equalized at some time prior to its entrance, leaving the mixer free to concentrate on entering and leaving it smoothly. The use of additional tracks for "sweetening" an overall effect, i.e. obtaining a composite of similar sounds, is sometimes justified, although the practice frequently is an indication of unsureness whether the sounds are really quite adequate individually. It is preferable to determine beforehand exactly what the overall sound is to be, spend a bit of time in locating or concocting an effect that is satisfactory in all respects, and laying a sound into the track that need not be monkeyed with at the mix. Much time — and discussion — at the re-recording session can thus be saved.

Loops

An overall sound may be run on a continuous loop and thus dialed in where required. It is at all times preferable, however, to have enough footage of the sound transferred (even if it originally came from a loop) so that it can be laid into one of the sound-effects tracks. There are two reasons for this preference:

(a) Any additional loop means another dubber; ergo another channel, another dial for the mixer to handle. The limitation as to the number of tracks running at any one time refers, of course, to loops as well.

(b) A more compelling reason lies in the point already mentioned that the relation of all tracks to one another should be familiar to the editor. A loop, unless run from a start mark, will hit willy-nilly — differently with each runthrough. In the case of very neutral backgrounds this fact is of little importance. The more salient features the overall sound contains, on the other hand (traffic with occasional auto horns and brake squeals; river background with prominent horns and whistles; crowd sounds with noticeable peaks and valleys), the more likely is it that a specific sound may occur where it is not wanted. It is good practice, as a matter of fact, to cut background sounds in such a way that clearly audible intermittent sounds fall into holes in the narration or lags in the music. Not only are they out of harm's way in such a position but they can effectively help to take up any slack in the pace of voice or music, or both. This practice need not, by the way, be carried to the extreme of placing these semiprominent effects so that they fall *only* into spaces in voice or music — then the result is apt to be a bit obvious. Obversely, not all chinks need be caulked up with effects in this manner, and certainly no attempt ought to be made to bring these sounds up from their position of background effects by raising their level in these places.

Loops do have their value, though. It is a piece of foresight, when editing continuous sounds, to make a good loop of each sound and lay it aside; the loop should be clearly identified, especially in the case of similar effects (light, medium, heavy traffic; quiet, restless, frantic crowd; etc.). Even the best-planned tracks sometimes require emergency assistance at a mix, and loops are excellent first-aid equipment in such a fix.

In sum, then, a complex and very complete soundtrack may be mixed from the following line-up of tracks:

Narration	*Music A*	*Effects A*
Dialogue	*Music B*	*Effects B*
		Effects C
		Effects D

— a total of eight tracks. This number need rarely be exceeded even in quite complicated jobs, and the total can frequently be kept down to good advantage.

Premixing

Premixing tracks consists of combining several individual tracks onto one track; to the resulting composite other elements are then added at a later runthrough to form the final track. The process is helpful in smoothing out disparate voice tracks. In the case of music and effects, however, premixing should be used with extreme caution; it is justified only if some of the individual tracks present an unusually large amount of technical problems which could not be solved at the time they were being edited, or the mixing studio has limited equipment available.

Premixing always means that the mixer loses a certain amount of control over the component parts of the premixed track. He finds himself, thus, in a position similar to the one described above where an individual sound cannot be handled without affecting other sounds around or underneath it. This loss of flexibility frequently becomes acutely evident at the time a premixed music and/or effects track is combined with the voice — at which point it is generally too late to do much about the situation. Premixing certainly should never be counted upon to reduce an awkward or sprawling layout of tracks to manageable proportions: it is not the re-recording engineer's job (for reasons of expense alone, if for no other) to correct flaws which the exercise of good judgment can obviate in the cutting room.

The above comments do not apply, of course, to the practice of combining several sounds onto magnetic film in order to obtain one composite sound effect, in other words premixing at any point *before* the final re-recording session.

Note: The term "soundtrack" refers either to the sound of a motion picture in general, or to the mixed track physically reproduced on the print. The term "sound track" refers to the individual track (*Voice*, *Music* or *Effects Track*) as described in editing and re-recording procedures.

Part I appeared in the March 1959 Journal. *Parts III and IV will appear in a subsequent issue. The entire paper is now available as a heavy covered reprint at the cost of $1.00 from the Society headquarters.*

Presented on October 24, 1958, at the Society's Convention at Detroit by Frank Lewin, Filmsounds, Inc., 128 East 41 St., New York 17, N.Y. This paper was received on August 4, 1958. *Edit. Note:* Publication of this tutorial paper is a result of the Society's policy to present from time to time pertinent subject matter which is not otherwise currently available.

A New Television Opaque Projector Designed by Radio Tokyo, JOKR-TV

By EIZO SUYAMA

An opaque projector capable of producing intricate and elaborate effects has been designed. Emphasis in the design is on simplicity and ease of operation. The main differences between the new projector and conventional ones is in respect to stage position (card projection position), and means of securing lap dissolve.

At most television stations in Japan, commercials and credit titles are not televised by slide projector but by opaque projector. This is because making a slide is expensive and it is also difficult to correct or change the lettering on a slide. Before the development of the opaque projector described below the majority of opaque projectors utilized a simple changing method, the lap dissolve, to change one view to the next.

A vertical or horizontal wide tape scroll can be attached to a conventional projector as an accessory but this single effect is insufficient to satisfy sponsors of TV programs. They often ask for new effects. The intricate and elaborate effects, desired by the sponsor, increase the likelihood of the operator's making mistakes. One of the first requisites for a projector is that it be simple to use, so that in an emergency the operator will not become confused. Even a small mistake may cause a sizable monetary loss.

There were certain limitations to be considered in designing the new projector. In conventional projectors opaque cards are contained in a five-card holder. If we were to adopt a new method of changing cards, for example if all the cards were piled up on a stage, such a method would not be applicable to both new projectors and older ones. In other words, if a projector or camera should break down, it would be impossible to exchange one type of projector for another. With these considerations in mind, it was decided to use either a five-card or a seven-card holder with the new projector.

A contribution by Eizo Suyama, TV Technical Dept., Radio Tokyo, Akasaka-hitotsugi-cho, Minato-ku, Tokyo, received on January 21, 1959.

Designing the New Projector

Figure 1 is a schematic of the system. The newly designed projector is shown in Fig. 2. The new projector differs from conventional ones most noticeably at the projection aperture position. The two opaque card stages are at the same vertical plane. In front of the two stages, a shelter plate is attached for picture wipe; and rotating blades connected with an arm are also used for another picture wipe. These can be put into gear by means of shafts.

Plates of various shapes can be inserted in each stage close to the card. The opaque part of each stage is lighted by two 500-w photoflood lamps each located at the same height from the center line of each stage. These two lamps are controlled by the handle of a variable resistor in the control panel. Reflected light from each illuminated stage reaches the pickup tube by means of surface mirrors and a half-mirror.

Irises are installed between the lamp base and the mirror. "Iris-in, iris-out" can be accomplished manually in a matter of seconds. Two irises are connected with an arm so as to operate together. Between the mirrors, a shutter which is controlled by a changeover solenoid has been installed for each stage.

Relays for changeover and an intercommunication amplifier are installed on the pedestal. A vidicon camera is used for picking up the image from the projector. Titles on opaque cards are written in an area of 3 by 4 in. The image on a 1-in. vidicon tube is $\frac{1}{2}$ by $\frac{3}{8}$ in., so that it is possible to attach a lens to the vidicon camera instead of the projector.

Dimensions of the unit are: height, 64 in.; width, 28 in. (including 6 in. for control panel); length, 30 in. The optical center line is 48 in. above the floor; the center of the upper stage is 56 in. above the floor and the center of the lower stage is 40 in. above the floor.

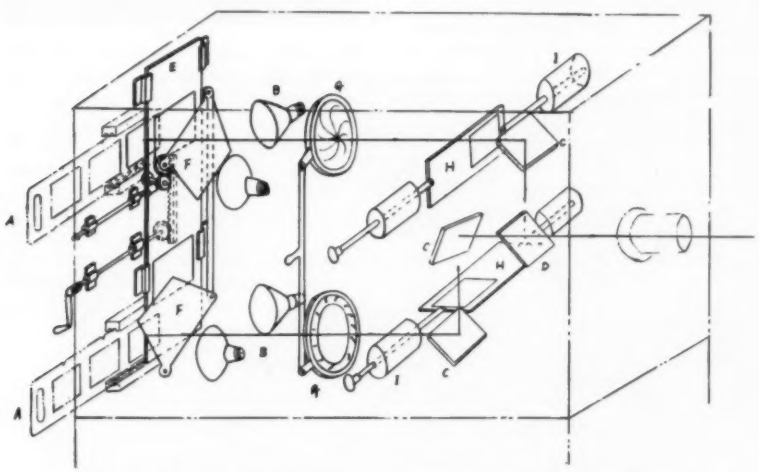


Fig. 1. Schematic of the opaque projector system. Legend: A, card holder; B, 500-w photolamp; C, mirror; D, half-mirror; E, shelter plate for vertical wipe; F, rotatable blade for radial wipe; G, iris; H, changeover shutter; I, solenoid.

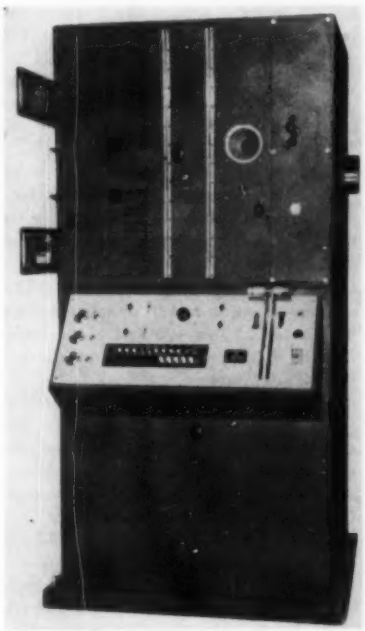


Fig. 2. Control side of projector; intercommunication switches (black and white) are installed in lower part of the control panel.

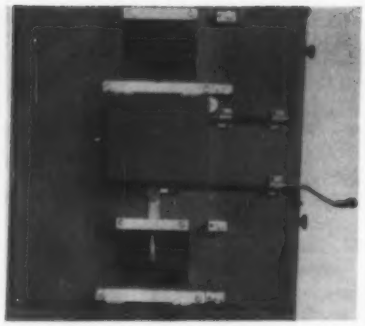


Fig. 3. Vertical wipe plate in half-way position.

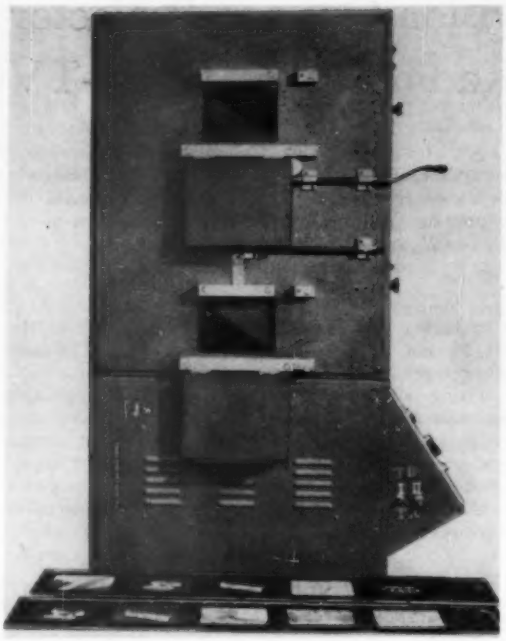


Fig. 4A. Rear view of projector showing rotating blade half-way through radial wipe.

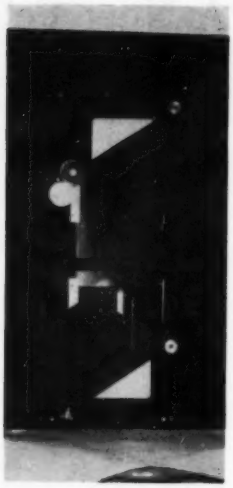


Fig. 4B. Blade assembly in same position as in Fig. 4A now seen from inside.

The New Projector in Operation

Two types of shutter plates are installed in front of the stages for picture wipe. When light paths from two stages are open and the two pairs of lamps are lighted, two pictures are transmitted to a pickup camera. As a result, the picture is overlapped. If an appropriate shelter plate is set in front of a stage, the other picture reaches the camera. When a shutter which has a horizontal edge moves vertically to the uncovered stage, the picture is changed from the uncovered picture to the covered one with a horizontal line effect. In other words, the pictures are wiped vertically from one to the other (Fig. 3). Only one projector and one camera are used in this case.

In order to make such a montage picture with an ordinary amplifier, two televised pictures from two TV projectors, or two scenes and two TV cameras are necessary.

Another pair of shutters, each moving radially on its axis in the corner of the stage, is also attached. This is for radial wipe (Figs. 4A and 4B).

An additional feature is a pair of changeover solenoids. Each shutter shaft is held by two solenoids horizontally on both sides. These solenoids push and pull the shutter in 1/30 sec or less and then open or close the shutter. The shutters are controlled by pushbuttons on a control panel. One set of the pushbuttons is for dual change and another is for single change.

The two shutter shafts, projecting toward the operator's side, are for manual use in an emergency, and the shafts can be used to wipe slowly, horizontally. If this occurs, the wipe line is, of course, out of focus.

The vidicon camera center is 48 in. above the floor, the center line of the upper stage is 8 in. above the camera center, and that of the lower stage is 8 in. below. These projection aperture positions enable the operator to change cards while he is sitting down (Fig. 5). Materials for projection on a camera are set in the same vertical plane. The operator can then check the order of materials from the back of the projector and can also scrutinize the setting of the card through the peep windows in the side panel. While the card holder is set in a stage, the scroll machine can be ready in back of the card holder. With the old machine, the operator was kept very busy changing material when the scroll followed some cards. The situation would become more confused when the director would send a cue to stand by quickly. With the new projector, no matter how complicated the situation, scroll or cards can be prepared immediately.

The control panel includes a selection knob for fader change, dual change and single change. Single change means that the upper and lower shutters can be opened or closed independently.

Intercommunication switches have been installed on the panel. The amplifier is in the pedestal of the projector.

Fig. 5. The projection aperture positions enable the operator to change cards while seated.

Future Development

The projector was completed in the autumn of 1956. At present, approximately 90% of the commercial TV stations in Japan are using this type of projector. There is one problem: One set of the card holders can hold in preparation 10 or 14 cards. Some TV programs use more than 10 or 14 titles without a break and, in this case, time is needed to exchange card holders. The five-card or seven-card holder can be adapted to this type of presentation by giving each object window a double stage. In other words, 20 or 28 cards can be set in four stages.

Acknowledgment

The author is indebted to Akira Kiryu, Chief Engineer of Seiki Mfg. Co., Tokyo, Japan, for his assistance in producing the new opaque projector.

Application of a Liquid Layer on Negative Films to Eliminate Surface Defects in Optical Printing

By RAYMOND H. DeMOULIN
PHILIP A. RIPSON, JR.
and STANLEY L. SCUDDER

When 35mm color negative films are used repeatedly for release printing, they may become badly scratched. These scratched negatives give 16mm release prints of inferior quality in an optical reduction printing operation. The effects of scratches on the negative can be eliminated by applying a thin layer of liquid to the support side of the film just before printing. A Depue optical printer was modified by adding a roller applicator and liquid reservoir and by using an undercut pressure pad at the gate. This method is simpler and less expensive than liquid immersion printing and produces prints of high quality.

Introduction

Previous articles have reported work done in this laboratory on techniques for printing color motion-picture films. In one method for contact printing, the negative and print films are immersed in a liquid at the printing gate.[1] For optical printing, the negative film is immersed in a liquid during the printing operation.[2] An evaluation of many liquids for these purposes has also been reported.[3] The object of this work — the need for eliminating the effects of scratches on the negative — has been discussed in these three articles.

The growing need for both 16mm and 35mm release prints for television and other uses warrants a special method for utilizing badly scratched negatives to make high-quality prints. Several motion-picture laboratories have indicated their desire to have a simple method for this purpose and have requested further investigation.

On some printers, the Depue optical printer for example, extensive modifications to the projector gate assembly are necessary to accommodate a liquid-immersion gate. There are several other good reasons for considering a system in which liquid would be applied only to the support side of the film. Most of the scratching of film occurs on the support side; slight emulsion scratches can usually be ignored; deep emulsion scratches will be colored and their printing effects cannot be eliminated with liquids in any case. In applying liquid to the support side only, a liquid would be chosen with a refractive index to match that of the support, 1.48. (Differences of 0.01 from the ideal are noticeably less effective in scratch elimination.) Accordingly, it seemed desirable to investigate the possibilities of a method of applying liquid to only the support side of the film.

In a preliminary experiment, a liquid was coated to a moderate thickness on a strip of 35mm film. It was observed that as the liquid evaporated, there was a period of one to several seconds in which the air-liquid interface became very flat and smooth. The advantages of making use of this effect in optical printing were obvious. It remained to choose the distance between the gate and the point of liquid application so that, at the operating speed of the printer, the desired smooth surface would occur during the interval of optical projection. This paper describes a simple, inexpensive method for applying a liquid to the support side of the film to be printed on a modified Depue optical printer.

A contribution submitted April 23, 1959, by Raymond H. DeMoulin, Philip A. Ripson, Jr., and Stanley L. Scudder, Eastman Kodak Co., Color Technology Div., Kodak Park Works, Rochester 4, N.Y.

Description of Apparatus

The optical printing apparatus used in these tests consisted of a Depue film-drive, optically aligned and synchronized with a Depue camera (Fig. 1). The condensing system was that of a Kodaslide Projector, Master Model. The 300-w lamp was cooled with a Fasco* blower. The filter pack was located immediately in front of the condensing system. The lens used was a Kodak Printing Ektar Lens, 1:1, 103mm, $f/2.8$. The printer operated at 50 ft/min.

As a means of applying a thin film of liquid onto the support side of the negative during the printing operation, a chamois-covered roller and liquid reservoir were placed between the supply reel and the negative gate, extending the loop from negative supply to feed sprocket by 24 in. Figure 2 is a close-up view of the chamois-covered roller, idler roller and reservoir. A schematic diagram of the film path is shown in Fig. 3. The printer can be converted from liquid- to dry printing simply by removing the loop from the applicator and idler rollers.

* Fasco Industries, Inc., Rochester, N.Y.

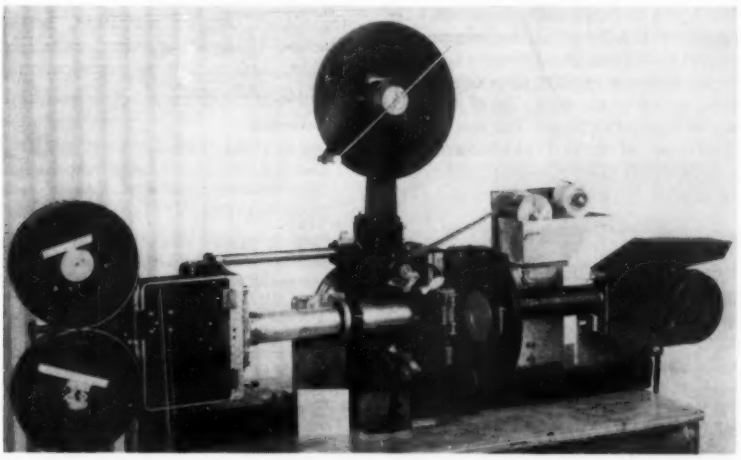


Fig. 1. Optical printer used for liquid-application printing.

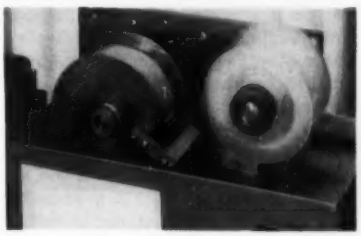


Fig. 2. Chamois-covered applicator roller.

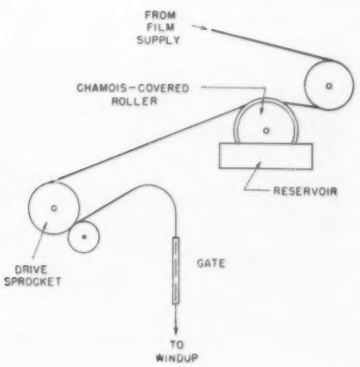


Fig. 3. Schematic diagram of film path.

Fig. 4. Prints from same negative made with and without liquid application.

The applicator was fabricated from a brass roller, $2\frac{3}{4}$ in. in diameter. A piece of chamois was stretched over the width of the roller, $\frac{15}{16}$ in. or 24 mm, so that liquid was applied only in the picture area of the negative film. The applicator roller rotates with the film, being driven by the film movement. The negative passes, support side down, over the roller, and is coated with a thin film of liquid, supplied by the rotation of the roller through the reservoir. The point of application is 19 in. from the gate. A wiper blade (Fig. 2) made of spring steel was used to control the amount of liquid applied to the film in order to produce the desired liquid surface at the instant of projection. Also, the use of the wiper blade reduced the need for a constant level of liquid in the reservoir.

Associated with all techniques of liquid printing is the need for drying the film before it is wound up. In our work, however, this requirement has been reduced by the application of a minimum amount of liquid to the film. Experimental work has shown that, with an efficient exhaust system, normal loop-drying is satisfactory, and the need for specially constructed drying cabinets is eliminated.

Results of Printing Trials

Negatives of several scenes and of a resolving-power chart were severely scratched on the support side with sandpaper and then printed by dry and liquid techniques. In liquid printing, the following three mixtures were applied at various thicknesses: Freon-113 liquid* – tetrachloroethylene; methyl chloroform – tetrachloroethylene; and Freon-113 liquid – toluene. It was found that for all liquids tested, a rate of about 80 ml per 1000 ft of 35mm film produced optimum results. Figure 4 shows black-and-white reproductions of prints made from a dry negative and from a negative with methyl chloroform – tetrachloroethylene applied. At a rate of 65 ml per 1000 ft the elimination of scratches was borderline; at 95 ml per 1000 ft, spattering of liquid was objectionable. Mixtures having Freon-113 liquid as one component tend to drift from the optimum index of refraction more rapidly than other mixtures, owing to the high rate of evaporation of Freon-113 liquid. For this reason, a mixture of methyl chloroform and tetrachloroethylene was used for most of the work described in this report.

Modification of Printer Head

During the tests it was found that droplets of liquid were spattered into the optical path by the flat surfaces of the pressure pad at the negative gate as the pad closed on the film just before exposure. These droplets were printed onto the print film out of focus and appeared on the screen as a "boiling" turbulence over the entire picture area. To eliminate this problem, an "undercut" pad was designed, with the flat surfaces cut away, leaving only knife edges to hold the film (Fig. 5). The undercut pad can also be used for dry film to produce prints equal in quality to those printed with the original pad, and requires no adjustment when converting to dry printing.

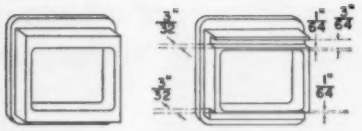


Fig. 5. Left, standard pressure pad. Right, undercut pad.

If liquid is applied too thickly, the intermittent action of the claw pulldown at the negative gate shakes droplets of liquid from the film into the optical path. These droplets produce the same turbulent effect as that caused by the original pressure pad. Also, excessively thick layers of liquid may spread into the perforations and spatter on the film during the film-advance, causing the "boiling" effect on the screen.

Conclusions

Badly scratched negatives can be printed satisfactorily on a Depue optical printer modified with an undercut pad by applying liquid to the support side of the negative at a rate of 80 ml per 1000 ft of film. Prints produced by this method were equal in quality to those produced by liquid-immersion techniques. It has been calculated from commercial price lists[4] that the cost for any of the liquids tested would be approximately ten cents per thousand feet of 35mm negative film. Although the method is limited by the same fundamental principles that apply to liquid-immersion printing,[1,2] it has several advantages over the latter technique: simpler operation, smaller amount of liquid required, simplified drying, and minimum modification of existing equipment.

References

1. John G. Stott, George E. Cummins and Henri E. Breton, "Printing motion-picture films immersed in a liquid. Part I: contact printing," *Jour. SMPTE, 66:* 607–612, Oct. 1957.
2. John R. Turner, Duane E. Grant and Henri Breton, "Printing motion-picture films immersed in a liquid. Part II: optical printing," *Jour. SMPTE, 66:* 612–615, Oct. 1957.
3. Donald A. Delwiche, James D. Clifford and William R. Weller, "Printing motion-picture films immersed in a liquid. Part III: evaluation of liquids," *Jour. SMPTE, 67:* 678–686, Oct. 1958.
4. Quarterly Report on Current Prices. *Chemical and Engineering News*, Dec. 29, 1958.

* E. I. du Pont de Nemours & Co., Inc., "Kinetic" Chemicals Div., Wilmington 98, Delaware.

Color Exposure for High-Speed Photography of Some Events Requiring Artificial Illumination

By K. H. LOHSE

To maintain good quality of artificially illuminated scenes recorded by means of high-speed photography requires an adequate amount of illumination with several sources of light properly positioned. Bulk and expense of light sources for high-speed photography have tended to restrict the number used for any given scene, with resulting inferior picture quality. The United States Steel Corporation has developed an improved and less expensive multiple-source illumination system which provides sufficient illumination to produce good-quality color photographs at speeds up to 4000 pictures/sec. Some of the considerations necessary for determining correct exposure parameters are listed and an example is presented for determining a color exposure.

Note: This paper supplements an earlier paper by the author, "Color Exposure for High-Speed Photography of Some Self-Luminous Events," published in the Journal *in September 1958.*

NOT LONG AGO, more often than not, high-speed photography was regarded as a novelty. But science and industry soon recognized its potential as a valuable tool in research, and the novelty quickly wore off. Today, many scientific and engineering studies have come to rely on the frequent use of high-speed photography. It is not unreasonable, then, to insist upon considerable improvement in the photographic quality of high-speed motion pictures.

Before any photograph can be useful in a research application, it must faithfully represent the subject. High-speed motion pictures are no exception, for no film is acceptable if the subject under study cannot be closely analyzed. A poorly lighted subject cannot yield a photograph that meets such requirements. One of the chief causes of the mediocre quality sometimes encountered in high-speed motion pictures is improper and inadequate illumination, which results in a film (Fig. 1) with an underexposed, contrasty subject on an insipid background. A typical example of such an improper lighting scheme is shown in Fig. 2.

For conventional motion pictures and still pictures, except in special circumstances, no such lighting problem exists. Through study and experience, minimum standards of lighting have been established. In taking a still picture or a conventional motion picture of, for example, a set of gears, the minimum lighting pattern would include the following pieces of equipment (Fig. 3): (1) fill-in light, (2) main or key light, (3) back light or kicker, (4) background light and (5) effect light. The use of such basic equipment results in a film (Fig. 4) with better tonal range, better modeling, less contrast, and more detail than that of Fig. 1.

It is pertinent to inquire why a high-speed motion picture of the same subject should be illuminated with a main light only, so that the resulting image of the subject lacks any modeling and most detail.

One explanation for the improper lighting of high-speed motion pictures is that the few available light sources, especially those designed for this type of work, are bulky. In addition, this equipment is expensive, the cost alone often prohibiting the purchase of five appropriate illuminators.

For work that does not require multiple-source lighting, however, the following lamps have been especially designed for high-speed motion pictures and are highly recommended:

(*1*) *Incandescent:* the Fastlite, a 1000-w high-intensity focusing spotlight with maximum output of 50,000 ft-c, distributed by the Wollensak Optical Co., Rochester, N.Y.

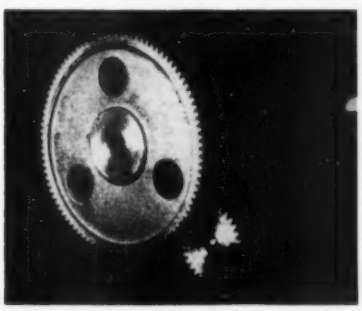


Fig. 1. Improperly illuminated subject.

Fig. 2. Lighting scheme resulting in insufficient high-speed illumination.

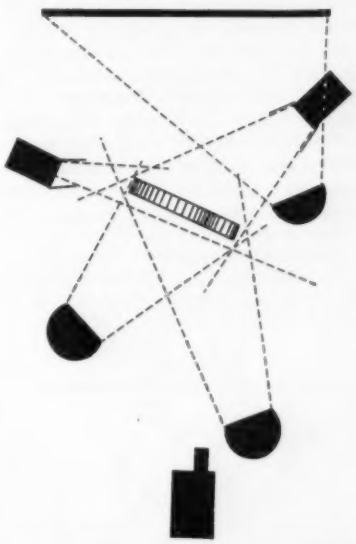


Fig. 3. Lighting scheme for conventional photography.

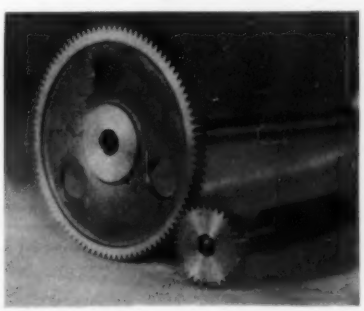


Fig. 4. Subject has been properly illuminated.

Presented on October 24, 1958, at the Society's Convention in Detroit by Karl-Heinz Lohse, now at Aeronutronic Systems, Inc., A Subsidiary of Ford Motor Co., 2701 Halladay St., Santa Ana, Calif. (At the time this paper was prepared Mr. Lohse was with U.S. Steel Corp., Research Center, Monroeville, Pa.)
(This paper was received on November 21, 1958.)

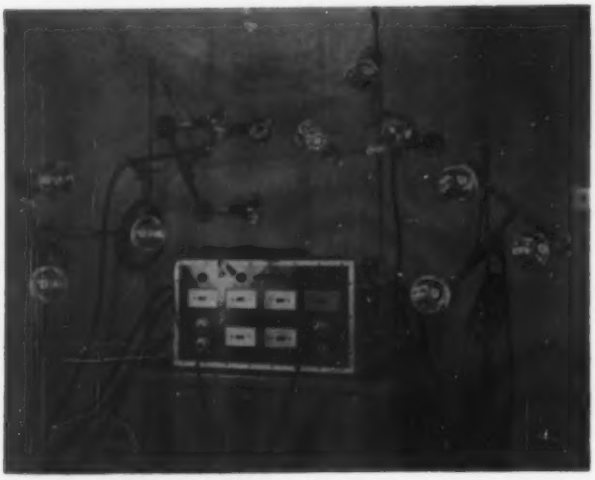


Fig. 5. Basic high-speed lighting unit.

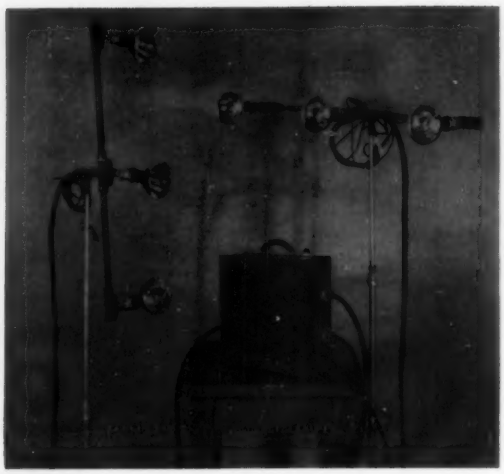


Fig. 6. Auxiliary high-speed lighting unit.

(2) *Arc:* the WF-360 High-Intensity Xenon Lamp, balanced for daylight emulsions, also distributed by Wollensak. The manufacturer claims that color film with an exposure index of 8 can be used at a taking rate of 16,000 pictures /sec.

(3) *Electronic Flash:* the Type 501 High-Speed Stroboscope, producing a repetitive electronic flash that can be synchronized with a high-speed camera up to a taking rate of 6000 pictures/sec. The peak output in candle power ranges from 100,000 to 400,000, depending on the equipment selected. The stroboscope is especially useful for high-speed cinemicrography or cinemacrography. This lamp is distributed by Edgerton, Germeshausen & Grier, Inc., Boston, Mass.

(4) *Multiple Flash:* Henry M. Lester High Intensity Illumination for High-Speed Motion Picture Photography, U.S. Patent No. 2,427,969.

The Edgar C. Bain Laboratory for Fundamental Research of the United States Steel Corp. has developed an improved system of lighting for high-speed motion pictures that minimizes the cost and provides sufficient light for most high-speed work as well as a great deal of flexibility.

The basic lighting unit consists of a control box and four lamps, each holding three 750-w reflector spot bulbs (Fig. 5). These four lamps, with a total of 9000 w, are used to perform the function of both the fill light and the main light. Complementing the basic unit is a unit that was designed primarily for time-lapse studies but can also be used as a background light, a kicker, or an effect light for high-speed work. This unit consists of a control box and two lamps, each holding three 750-w reflector bulbs (Fig. 6). Depending on the lighting desired, the 750-w bulbs can be replaced by RSP 2 or RFL 2 bulbs to produce, respectively, a lower light level or a floodlight effect. The new Westinghouse 300-w photographic reflector spot bulb can be used with advantage at very short lamp-to-subject distances because of its smaller size. The circuitry of the units is shown in Figs. 7A and 7B. The lights are controlled by the event circuit of the camera so that they burn brightly only during the actual exposure. For viewing and focusing, the lights are dim. A remote control switch is provided to permit the brightening of the lights during the light measurement.

A typical arrangement of lighting

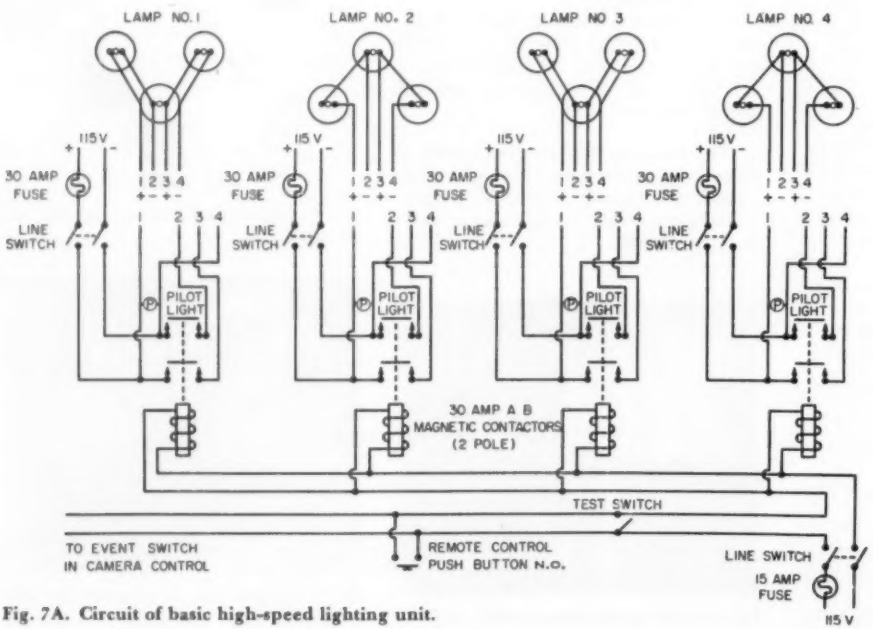


Fig. 7A. Circuit of basic high-speed lighting unit.

Table I. Typical Light-Meter Readings in Foot-Candles for One to Four Lamps of the Basic Unit.

Lamp-to-subject distance, ft	Light-meter reading, ft-c			
	One lamp	Two lamps	Three lamps	Four lamps
1	85,000	—	—	—
2	21,000	50,000	60,000	75,000
3	11,000	19,000	35,000	50,000
4	4,500	11,000	17,000	23,000
5	2,100	7,000	12,500	17,000

components is shown in Fig. 8. By this system of lighting, high-speed subjects can be illuminated in a manner very similar to that of still subjects. Since each lamp has the same light output, balanced lighting is accomplished by varying the distance and the angle of lamp to subject. An added advantage of the circuit is that the power input can be distributed among several circuits. For example, by plugging the basic unit into a number of 30-amp outlets a total of about 150 amp is made available.

Table I shows some typical incident light-meter readings in foot-candles by using one to four lamps of the basic unit at various lamp-to-subject distances for lamps placed near the optical axis of the camera. Each lamp was equipped with three 750-w, 115-v intermittent service photographic reflector spots. According to E. T. Higgons,[1] each bulb is rated, at a lamp-to-subject distance of 18 in., at 16,000 ft-c in an 8-in. circle. All bulbs were aimed at a 12-in. circle in the subject plane by means of swivel sockets. Thus, the intensity can be varied from 2100 ft-c to 85,000 ft-c.

As an approximate guide, the conversion from the incident to the reflected light method of measurement is approximately 10 to 1 if the white card method is used or 50 to 1 if the reflected light is measured from an 18% neutral-gray card. For example, an incident light reading of 50,000 ft-c corresponds to an 800 ft-c reflected light reading when the 18% gray card is used; in the same manner, 17,000 ft-c incident is equivalent to 400 ft-c reflected. The reflected light method is preferred, especially when a subject is filmed which at the beginning is cold and non-self-luminous but which is heated during the event cycle to become self-luminous. In such an instance, the proper exposure is determined by taking the highest self-luminous reading and then adding to it not more than half that amount in artificial illumination. It is well to remember that during such an event the reflectivity of the subject changes, depending on the material.

In arranging the artificial illumination for non-self-luminous events, the main light is placed first. The amount of reflected foot-candles is measured by holding an 18% gray card in the subject plane. This reading is used in calculating the exposure. Next, the fill light is placed so as to yield the desired lighting ratio, which will be lower for color than for black-and-white. The background material should be carefully selected. For color photography, a light-colored background complementary in color to the event is preferred. The background light is then placed to light the background evenly and with about the same intensity as that provided by the fill light. Finally, the kicker, or effect light, is placed to produce the desired effect but is not considered in calculating the exposure.

The problem presented by self-luminous events requiring artificial illumination is somewhat different. The artificial light required for color photography must match in color temperature the self-luminous event. For example, in photographing a welding arc to produce an image of both the electrode and the welded surface, the use of considerable artificial illumination is indicated. Because of the high color temperature, it is necessary to place daylight-type light sources or daylight-type blue filters in front of 3400 K bulbs. Consequently, when daylight-type color film is used, the system is well balanced. In calculating this exposure, only the light emitted from the welding arc is considered. The subject is then treated like a self-luminous event not requiring artificial illumination.

For self-luminous events lower in degrees Kelvin than the film emulsion is balanced for, especially for fires and flames and some liquid metals where it is important to record the surrounding areas, the color temperature of the auxiliary artificial illumination has to be lowered by means of variable voltage transformers to match the color temperature of the event. Because this method reduces the light output, an alternate method yielding more efficient light is to filter the light with color-compensating filters and to apply normal voltage. For either method, the color-compensating filters for the taking lens are then chosen to compensate for the difference between the color temperature of the event and that of the film emulsion used. For low-intensity, self-luminous events, the additional artificial illumination must not exceed one-half of the brightness of the event. The exposure calculation for such events is then based on the event only.

Photomacrography

For small events requiring the use of photomacrographic techniques, there are two important considerations: (1) the proper calculation of effective aper-

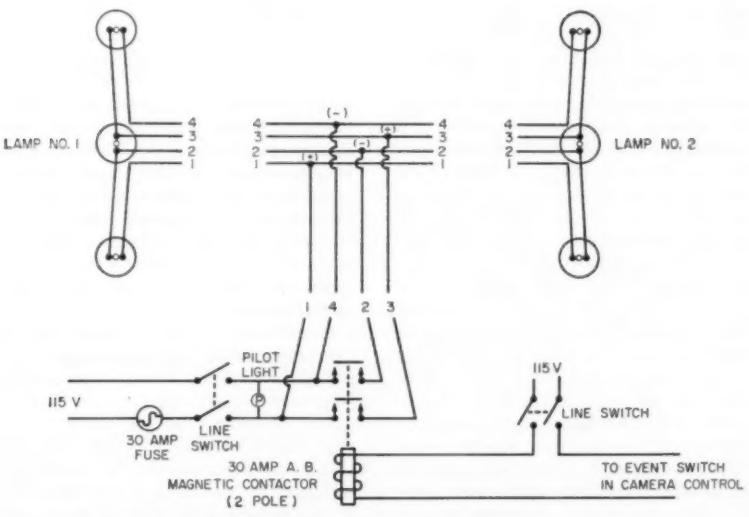


Fig. 7B. Circuit of auxiliary high-speed lighting unit.

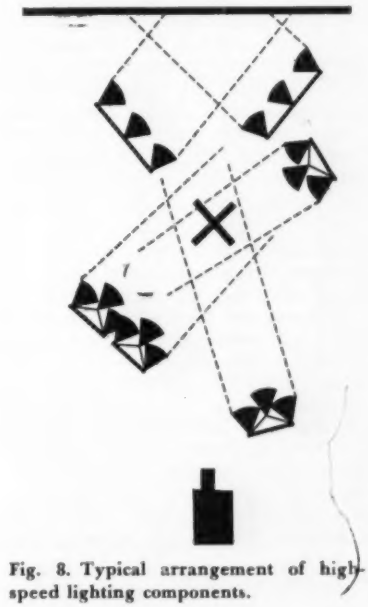


Fig. 8. Typical arrangement of high-speed lighting components.

Table II. Working Distances and Field Widths of Four Typical Lenses Used for 16mm High-Speed Close-up Motion Pictures.

Lens extension, in.	Subject-to-film distance, in.	Working distance, in.	Field width, mm
(Wollensak Fastax-Raptar f/2) 35-mm Lens			
4	$7\frac{7}{16}$	$\frac{1}{2}$	3.1
$3\frac{1}{2}$	7	$\frac{11}{16}$	3.25
$3\frac{1}{4}$	$6\frac{3}{4}$	$\frac{3}{4}$	3.8
3	$6\frac{1}{2}$	$\frac{11}{16}$	4.1
$2\frac{3}{4}$	$6\frac{1}{4}$	$\frac{13}{16}$	5.0
$2\frac{1}{2}$	6	1	5.5
2	$5\frac{11}{16}$	$1\frac{5}{16}$	6.5
$1\frac{3}{4}$	$5\frac{9}{16}$	$1\frac{7}{16}$	8.1
$1\frac{1}{2}$	$5\frac{3}{8}$	$1\frac{7}{16}$	9.3
1	$5\frac{1}{4}$	$2\frac{1}{8}$	13.2
$\frac{5}{8}$	$6\frac{9}{16}$	$3\frac{1}{4}$	21.0
$\frac{3}{8}$	$9\frac{1}{8}$	$6\frac{1}{8}$	38.0
2-in. Lens			
4	9	$\frac{5}{8}$	4.5
$3\frac{1}{4}$	$8\frac{1}{2}$	$\frac{3}{4}$	5.0
$3\frac{1}{8}$	$8\frac{1}{2}$	$\frac{7}{8}$	5.6
3	$8\frac{1}{4}$	$1\frac{1}{4}$	6.25
$2\frac{1}{8}$	$8\frac{1}{4}$	$1\frac{1}{2}$	7.0
$2\frac{1}{8}$	$8\frac{1}{4}$	$1\frac{1}{2}$	8.0
2	8	$1\frac{3}{4}$	9.25
$1\frac{1}{8}$	$8\frac{1}{8}$	$2\frac{3}{8}$	11.5
$1\frac{1}{8}$	$8\frac{1}{8}$	$2\frac{7}{8}$	13.25
1	$9\frac{1}{2}$	4	19.0
$\frac{1}{8}$	$11\frac{3}{8}$	$6\frac{3}{4}$	32.0
$\frac{3}{8}$	$16\frac{3}{8}$	12	54.5
(Wollensak Fastax-Raptar f/3.5) 4-in. Lens			
4	$16\frac{1}{8}$	$6\frac{1}{2}$	9.5
$3\frac{5}{8}$	$16\frac{1}{4}$	$6\frac{3}{8}$	10.0
$3\frac{3}{8}$	$16\frac{1}{4}$	$6\frac{3}{8}$	10.75
3	$16\frac{1}{2}$	7	12.25
$2\frac{5}{8}$	$16\frac{7}{8}$	8	14.0
$2\frac{3}{8}$	$17\frac{1}{8}$	$8\frac{7}{8}$	15.75
2	$18\frac{1}{4}$	10	18.5
$1\frac{5}{8}$	$19\frac{1}{2}$	$11\frac{3}{8}$	22.5
$1\frac{3}{8}$	$21\frac{1}{8}$	$13\frac{7}{8}$	27.25
1	$25\frac{3}{8}$	$18\frac{1}{4}$	37.5
$\frac{3}{8}$	$36\frac{3}{4}$	$29\frac{7}{8}$	64.5
$\frac{1}{8}$	$51\frac{3}{4}$	$45\frac{1}{8}$	100.0
(Wollensak Fastax-Raptar f/4.5 Cine Telephoto) 6-in. Lens			
4	$26\frac{3}{4}$	$16\frac{1}{4}$	13.7
$3\frac{5}{8}$	$27\frac{1}{4}$	$17\frac{1}{8}$	15.2
$3\frac{1}{4}$	$27\frac{1}{2}$	$17\frac{3}{4}$	16.5
3	$28\frac{3}{4}$	$19\frac{1}{4}$	18.5
$2\frac{5}{8}$	30	$20\frac{7}{8}$	21.0
$2\frac{3}{8}$	31	$22\frac{1}{8}$	23.0
2	$33\frac{1}{4}$	$24\frac{3}{4}$	27.0
$1\frac{5}{8}$	$36\frac{1}{2}$	$28\frac{3}{8}$	32.5
$1\frac{3}{8}$	$40\frac{3}{4}$	$32\frac{7}{8}$	39.5
1	$49\frac{3}{4}$	$42\frac{1}{4}$	54.5
$\frac{5}{8}$	$69\frac{1}{2}$	$62\frac{3}{8}$	84.0
$\frac{3}{8}$	98	$91\frac{1}{8}$	128.0

ture based on lens extensions,* and (2) the accurate measurement of reflected foot-candles. The latter is complicated by the fact that only the light that actually reflects from the subject should be considered. Because the lamps cannot always be concentrated on such a small area, spilled light is often present, and measuring the spilled light will account for many underexposed high-speed films. Therefore, the conventional calculation of exposure based on the square law is generally not applicable.

* New f-stop $= \dfrac{\text{set } f\text{-stop} \times \text{lens-to-film distance}}{\text{focal length of lens}}$

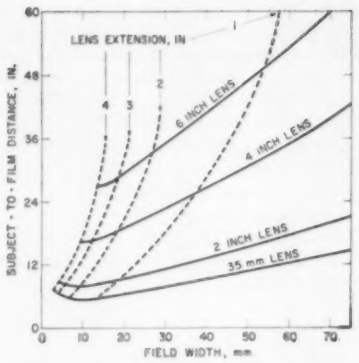


Fig. 9. Relationship between close-up field width and subject-to-film distance for four typical lenses.

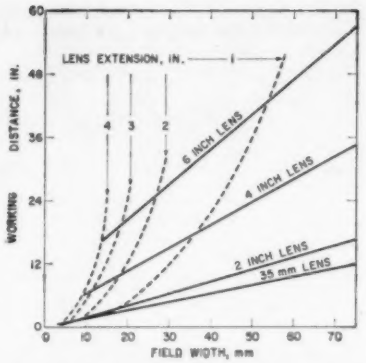


Fig. 10. Relationship between close-up field width and working distance for four typical lenses.

The selection of the appropriate lens for extreme close-up photography is based on the field width, the lens extension required to obtain the necessary field width, and the mechanical distance between the front of the lens and the subject. Table II correlates the lens extensions with subject-to-film distance, mechanical or working distance, and field width for four typical lenses used in high-speed close-up photography. In Fig. 9, field width is plotted against film-to-subject distance for these lenses. Figure 10 shows the relationship between close-up field width and working distance for four typical lenses. Though the shorter focal length lenses require less extension, they provide less favorable working distance, which is a disadvantage if the subject requires artificial illumination. Mirrors, semitransparent mirrors, and reflectors, examples of which are illustrated in Fig. 11, occasionally are valuable tools for improving the lighting of photomacrographic subjects. For some self-luminous subjects that might damage the lenses, a larger working distance is highly desirable. In such applications, the use of quartz glasses in front of the lens is recommended as a protective measure. The use of close-up supplementary lenses instead of, or in conjunction with, extension tubes is often helpful. Another interesting possibility for extreme close-up work is the combination of two long-focus lenses in addition to an extension tube. For example, combining a 6-in. lens, a 4-in. lens, and a 4-in. extension tube allows a field of 3.0-mm width to be photographed at a working distance of $1\frac{1}{2}$ in. This compares favorably with a working distance of $\frac{5}{8}$ in. for the same field width when a 35-mm lens with a 4-in. extension tube is used.

Fig. 11. Mirrors and reflectors for high-speed cinemacrographic illumination.

Photomicrography

For events of microscopic size, an ever-present problem is vibration. Another difficulty is the fact that subject magnification also produces magnification of subject motion. The choice of framing rate must be governed by considering the subject velocity and the field size. According to J. Waddell[2] the smallest image displacement that can be tolerated from one frame to the next is five times the resolving power of the film. Consequently, high framing rates are usually required for high-speed cinemicrography. As a result, conventional illuminators used for general microscopy are inadequate for high-speed cinemicrography, though one suitable light source, the stroboscope, was cited above. Several workers have used various light sources, mostly those especially designed for a specific experiment.[3] Projector-type bulbs have been substituted for regular microscope light bulbs. Camera-synchronized repetitive electronic flash has been adapted. For short cycles, single long-peak flashbulbs have also been used. No matter what type of light source is used, however, it must be emphasized that photoelectric light measurements are not always reliable because the overall brightness of the microscopic field is measured rather than that portion of the field that is of prime interest. For this reason, the basic exposure is usually determined by means of a test exposure. In conducting such tests, a black-and-white still exposure is often a good start-

ing point. Once the basic exposure has been established in this way, changes in magnification, objectives (numerical aperture), oculars, and filters can be calculated in the same manner as for still photomicrography. (Tables of some of these factors are available in *Photography Through the Microscope*, published by the Eastman Kodak Co.[4]) Clearly, the whole field of high-speed cinemicrography is relatively unexplored.

An event illuminated by transmitted light can be regarded as a special kind of self-luminous event. The chief distinction is that the transmitted light can be well controlled. Most transparent subjects fall under this category. Especially in high-speed cinemicrography many such events are encountered. The exposure calculation is the same as for self-luminous subjects.

Polarized light and cross-polarized illumination, with or without the use of wave-retarding material, are also frequently encountered in high-speed cinemicrography of a crystallographic specimen or in photoelastic stress analysis. Because of the great light loss, characteristic of this kind of illumination, the maximum light output should be provided. The normal exposure factors must be increased considerably. It is not uncommon to use an exposure factor of 20 to 40 for a high-speed application in contrast to an exposure factor of 4 to 12 for comparable still photomicrography. If a phase-difference microscope is used, a bright contrast or a B-minus contrast should be preferred to a dark contrast because of the higher light transmission.

A recent though infrequent application is the high-speed photography of electron-microscope screens. So far, the use of color films has not been required. In the future, the extremely low light levels encountered may be overcome with the use of light amplification systems.

High-speed color films, processed to maximum speed, have been used successfully.

Exposure Calculation

The complexity of determining the proper color exposure for high-speed motion pictures can be better realized by first reviewing what is involved in calculating the proper exposure for still photography. In still photography, the factors listed below must be considered:

(*1*) *Subject* (size and motion and, if the event is self-luminous, color temperature);

(*2*) *Light* (intensity and color temperature);

(*3*) *Exposure time;*

(*4*) *Film* (speed and color balance of emulsion); and

(*5*) *Aperture.*

These factors are interrelated as follows: At a constant film speed, a given subject illuminated by a constant light requires a certain light value setting (LVS), LVS being a combination of exposure time and the corresponding aperture. There are only a few dependent interrelations. The motion of a subject may call for a shorter exposure time, which will require a larger aperture. The color temperature of the event may require filtration, which will affect the LVS combination. However, the calculation is simplified because most factors are constant.

This same method of calculating the exposure in still photography has been adapted to high-speed motion pictures. That is, the calculation is based on a given amount of foot-candles, a constant pictures/second rate (this rate is sometimes erroneously used as an expression of exposure time), and a constant film speed (which is determined by tests). By a proper selection of these three factors, an *f*-stop is determined. This method is in wide use in the field of non-self-luminous events photographed in black-and-white. Because of the wide latitude of black-and-white emulsions and the somewhat less pronounced reciprocity law failure of such films, especially for framing rates of 2000 pictures/sec and slower, the method has yielded many well-exposed, high-speed films.

However, in working with color films and self-luminous events, and prescribing correct exposures within $\frac{1}{3}$ *f*-stop, the above method is not accurate enough. To attain a higher degree of accuracy, a much more complex system of exposure calculation must be used.

For color exposures of high-speed motion pictures of events requiring artificial illumination and embracing photomacrographic and photomicrographic applications, the interrelation of many factors must be considered. These factors are listed as follows:

(*1*) *Event* (a) Relative subject motion (cyclic or erratic),
(b) Direction of motion (constant or variable),
(c) Luminescence (constant or variable),
(d) Color temperature (constant or variable), and
(e) Size;

(*2*) *Light* (a) Output,
(b) Spectrum,
(c) Color temperature,
(d) Distance from event, and
(e) Use of mirrors and/or reflectors;

(*3*) *Light measurement* (a) Reflected,
(b) Incident, and
(c) Transmitted;

(*4*) *Technique* (a) Choice of lens,
(b) Depth of field,
(c) Photomacrography, and
(d) Photomicrography;

(*5*) *Camera* (a) Framing rate (variable),
(b) Performance (variable in terms of characteristic curves),
(c) Exposure time (variable),
(d) Effective aperture (variable), and
(e) Selected aperture;

(*6*) *Film* (a) Speed (variable, depending on exposure time),
(b) Reciprocity law failure (variable within emulsion layers), and
(c) Color balance (variable from batch to batch);

(*7*) *Use of filters;* and

(*8*) *Line voltage.*

The complexity of the problem becomes more evident when the interrelations between these factors are considered. Another complicating condition is the number of variable factors that must be correlated within a short period of time. A consideration of all the above factors leads to a method of solving even the most difficult exposure calculation. An illustration will serve to show how this method can be used as a guide in solving other equally difficult high-speed color exposure calculations.

For purposes of simplification, assume a hypothetical event: a small, hot flame melting the surface of a subject. The field width is 1 in. The flame has a color temperature of 3400 K and emits 800 ft-c. A further assumption is that the action requires a framing rate of 4000 pictures/sec. Reversal 16mm color film is being used, which has a normal film speed of E.I.32 and which is balanced for 3200 K. All other factors affecting the exposure determination can then be correlated with the given factors. Though the conditions described above do not represent a true photomacrographic application (true photomacrography covers subject magnification on film from 1:1 to 1:20), the exposure calculation is similar to that used in photomacrography.

First, the lens must be carefully selected. Though a lens of shorter focal length may require less lens extension, a lens of longer focal length should be chosen to obtain a lens-to-subject distance as large as practicable. For a 16mm high-speed camera, an appropriate choice would be a 4-in. lens with a $1\frac{3}{8}$-in. extension tube, which would yield a 22-in. subject-to-film distance, or about a $16\frac{1}{2}$-in. working distance (Table II). This selection will give sufficient room to illuminate the event. Two high-speed lamps of the type described above, placed $2\frac{1}{2}$ ft from the event and close to the optical axis, will yield a 2 to 1 lighting ratio between the flame and the fill light. The back lights, the background, and the background lights are then placed, but their effect is not considered in the exposure calculations. (Background illumination enters the exposure calculation only when an effect of silhouetting the subject against the background is desired.)

Next, from the characteristic exposure time curves,[6] the curve is selected that has an average framing rate of 4000 pictures/sec. Depending on the type of camera used, this will give, for example, an exposure time of 1/25,000 sec/frame.

The latest information on Fastax exposure times was found to be:

$$\text{exposure time} = \tfrac{1}{3} \times \frac{1}{\text{pictures/sec}}$$

according to the Wollensak Optical Co. *Lens and Shutter Guide*. At this stage, the basic exposure of the event is determined from the film speed, the light produced by the flame in foot-candles, and the exposure time.

For a first film, a test exposure is generally used to determine the basic exposure. From previous experience a basic aperture of $f/4.5$ is correct for the example cited. This basic lens opening is now modified by the following factors: reciprocity law failure, filters and effective aperture (as governed by lens extensions). To obtain an effective aperture of $f/4.5$ at the given lens extension, the f-stop setting is changed to $f/1.5$. For the film used, the reciprocity law failure at an exposure time of 1/25,000 sec requires one additional f-stop for neutral-density loss, and the use of a color-compensating filter requires at least an additional $\frac{1}{3}$ f-stop because of the different reciprocity law failure in the emulsion layers. Filtration to compensate for the 200 K difference between illumination and color film balance requires further adjustment, less than $\frac{1}{3}$ f-stop. Thus, the final aperture becomes approximately $f/0.7$. Of course, if a lens of this speed is not available, certain sacrifices have to be made. Either a faster film must be used or a slower framing rate must be selected, each of which again changes part of the calculation.

Rotating prisms present a limitation as to minimum f-number. The limit is near $f/2$ and therefore the use of a faster lens becomes ineffective.

This example of calculating the color exposure is given to show the general approach and the step-by-step procedure. The method is applicable to a wide variety of subjects and filming conditions.

Acknowledgment

The author gratefully acknowledges the help of Henry D. Patterson, who edited the original manuscript. S. Lentz and R. E. Jungo of the Edgar C. Bain Laboratory's Photographic Section contributed greatly in assisting in the field tests. Thanks are also due to the Electrical Department of the United States Steel Research Center for constructing the light sources.

References

1. E. T. Higgons, "Exposure meter for high-speed photography," *Jour. SMPE, 53:* 545–548, Nov. 1949.
2. J. H. Waddell and J. W. Waddell, *Photographic Motion Analysis*, p. 4, Industrial Laboratories Publishing Co., Chicago.
3. A. W. Zorgniotti, R. S. Hotchkiss and L. C. Wall, "High-speed cinephotomicrography of human spermatozoa," *Medical Radiography and Photography, 34:* 44–47, No. 2, 1958.
4. *Photography Through the Microscope*, Eastman Kodak Co., 1957.
5. K. H. Lohse, "Color exposure for high-speed photography of some self-luminous events," *Jour. SMPTE, 67:* 567–571, Sept. 1958.

Errata

"Progress Report," *Jour. SMPTE, 68:* 277–329, May 1959.

On page 310, the FP 20-S Projector with SPP 800 lamp is illustrated in Fig. 61 and described in the text in the section contributed from Germany. Although cited as developed by Philips in Holland, the development might also have been cited in the report from Great Britain where the equipment has received attention. It is hoped that in future Progress Reports a section direct from Holland can be included.

On page 316, an addition of credit should be made for Fig. 76, to read: "Fig. 76. The Tecnoscope Model 110 Printer; camera and projector head are 'Acme,' built in U.S.A. by Producers Sales Corp."

motion-picture standards

Proposed American Standard

A Proposed American Standard, PH22.107, Film Spools for 8mm Motion Picture Cameras, is published here for a three-month period of trial and comment.

This proposed standard was previously published in the January 1956 *Journal* for trial and comment. Comments were received and it was returned to the initiating 16 & 8mm Committee. The method of dimensioning the keys was changed necessitating revisions in the diagram and table of dimensions. Paragraphs 2.4, 3.3 and 3.4 were revised and Appendices were added to improve the clarity of the proposal.

All comments should be addressed to Society Headquarters, attention of J. Howard Schumacher, Staff Engineer, prior to September 15, 1959. If no adverse comments are received, the proposal will then be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.—*J.H.S.*

Proposed American Standard

Film Spools for 8mm Motion-Picture Cameras

PH22.107

1. Scope

1.1 The dimensions shown in this standard are for 8mm motion-picture film spools with a nominal capacity of 25 ft. These spools are used in cameras of the type in which each roll of film is passed through the camera twice for exposure in accordance with American Standard 8mm Motion-Picture Film, Usage in Camera, PH22.21-1953, or latest revision thereof approved by the American Standards Association, Incorporated. The spindle holes in the spool are shown with splines which are intended to assist in assuring correct orientation of the spool in the camera.

2. Operation in Camera

2.1 When the spool is on the supply spindle, the flange with the 3-splined spindle hole, flange A, shall be on the lefthand side (as seen from the lens).

2.2 The half of the film adjacent to the flange with the 3-splined hole, when the spool is on the supply spindle, shall be in line with the camera lens.

2.3 When the spool is on the take-up spindle, the flange with the 4-splined spindle hole, flange B, shall be on the lefthand side (as seen from the lens).

2.4 When the loaded camera is viewed from the side, with the lens to the left, both the supply and take-up spools shall rotate in a clockwise direction.

3. Dimensions

3.1 The dimensions shall be as given in the diagram and table.

3.2 If rivet heads or other fastening devices extend beyond the outer surface of the flange, they should lie within the zone indicated by diameters K and L and be no higher than indicated by G. It is not intended that this standard prescribe the nature or number of these fastening devices.

3.3 Dimension H is the space between the flanges at all points. At all points between the core and the periphery the tolerance shall be ± 0.006 in. Inside the core, including the inner surfaces of the splines, the tolerance shall be ± 0.010 in.

3.4 Dimension J specifies the overall thickness (with the exception of the fastening devices). For the zone immediately surrounding the spindle hole, the tolerance shall be ± 0.010 in. (0.25mm). For the rest of the flange area, the tolerance shall be + 0.010 in. (0.25mm) with no limit on the negative tolerance.

3.5 Dimension F specifies the width of slot in the core for attaching end of film.

3.6 It is not intended that the relative orientation of the splines in the two spindle holes (or of the core slot) be specified or implied by this standard.

3.7 The following tolerance applies to the flatness and accuracy of rotation of both the internal and external flange surfaces, including rivets or other fastening devices. When the spool is rotated on an accurate, tight-fitting spindle, the maximum outward deviation from the intended plane for any point on the flanges shall not exceed 0.015 in., (0.38mm). The "intended plane" is defined as a plane normal to the axis of the spindle: for the outer surface of the flange, it shall be coincident with the surface of the flange over an area ½-in. in diameter centered about the spindle hole. For the inner surface it shall be coincident with the surface adjacent to the core.

NOT APPROVED

APPENDICES

(These Appendices are not a part of Proposed American Standard Film Spools for 8mm Motion-Picture Cameras, PH22.107, but are included to facilitate its use.)

APPENDIX 1

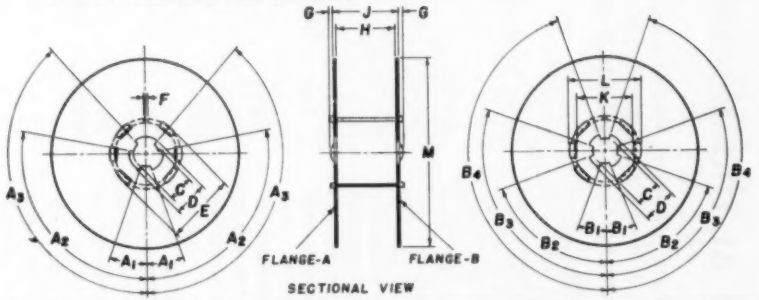
The spool thickness "J" specified by this standard is in accord with current practice for new spools and with the requirements of existing cameras. However, there are in existence and use spools of older design ranging up to 0.743 in. (18.87mm) in thickness.

APPENDIX 2

The angular dimensions and tolerances for the width of the keys, "A" and "B" (or tongues), in the spindle holes are in accord with current practice for new spools and with the requirements of existing cameras. However, there are in existence and use spools of older design with keys slightly wider by 1° to 2° on each edge of each key.

APPENDIX 3

Camera spindles should allow for a radius of not more than 0.015 in. (0.38mm) at each corner of each key and spline.



SECTIONAL VIEW

Dimensions	Degrees	Dimensions	Inches	Millimeters
A_1	19¼ ± 1	C	0.288 $^{+0.007}_{-0.004}$	7.32 $^{+0.18}_{-0.10}$
A_2	100¾ ± 1			
A_3	139¼ ± 1	D	0.384 min	9.75 min
B_1	19¼ ± 1	E	0.750 ± 0.015	19.05 ± 0.38
B_2	70¾ ± 1	F	0.035 ± 0.020	0.90 ± 0.50
B_3	109¼ ± 1	G	0.015 max	0.38 max
B_4	160¾ ± 1	*H	0.641	16.28
		**J	0.720	18.29
		K	0.600 min	15.24 min
		L	0.812 max	20.62 max
		M	2.031 ± 0.015	51.59 ± 0.38

* See ¶ 3.3
** See ¶ 3.4

NOT APPROVED

Excerpts — Speeches at the Miami Beach Convention

The speech of welcome was delivered by President Norwood Simmons May 4, 1959, at the Get-Together Luncheon of the Society's 85th Convention. Mitchell Wolfson, President, Wometco Theatres, Inc., Miami, was Guest Speaker at the Luncheon. The special address by Major General John B. Medaris on Monday evening is planned for excerpting later for Journal *Publication.*

Evolution and Progress

By NORWOOD L. SIMMONS, *SMPTE President*

I BELIEVE . . . every delegate at this convention (felt it) a rare privilege . . . afforded him this week: A happier combination of opportunity to learn and a delightful place in which to do it cannot easily be imagined. Miami Beach is a lovely city — warm and gracious. . . . It is with much personal pleasure that I thank the members of our Board of Governors who several years ago voted that this convention be held in Miami Beach.

The manner in which our local members took command, once the decision was made to hold a convention here, and the tremendous effort which they have put forth, deserves our warmest thanks.

This convention is marked with an international flavor. It is the result of much effort by your Program Committee. Program Chairman Gar Misener, with special assistance from the local Associate Program Chairman Andy Beal, has assembled technical sessions of papers, many from outside the United States, covering the wide and timely interests of the Society. All the local arrangements and management of the week's show have been accomplished under Local Arrangements Chairman Norman Bean (see full story in news pages later in this *Journal*). . . .

We are particularly proud of the international equipment exhibit since it is the largest ever held by the SMPTE. . . .

The single word that best describes to me what has been going on in both our industry and our Society itself during the recent past is "evolution." In Hollywood we are witnessing a changing scene as the old-line major studios are gradually converting wholly or in part to television film production. There have been some rather drastic economic consequences of this shift. Instead of a continuation of the trend toward single ownership of all services and technical facilities that are needed in the making of a motion picture, we have seen a move toward establishment of specialized services of all kinds. Many studios have divested themselves of laboratory, sound department, camera department, and special-effects department. These operations have in many cases become commercial entities and offer their services on the open market, not only to the producer of films for entertainment, whether these be viewed in the theater or in the home on a TV set, but also to the producer of nontheatrical films. These shifts have increased the competition for the independent film producer's business. This results in more emphasis on good engineering practices. It means more opportunity for well-trained motion-picture and television engineers than has ever existed before.

Interest in many of the problems relating to the production of films for television is at fever pitch. This field is new enough so that engineers are pioneering in new techniques. Interest is reflected in the programs of our local sections and in the program content of this convention.

At the same time, there has been a tremendous growth in the use of the new, versatile technique, magnetic video recording. This method of recording TV programs has received such nationwide publicity in the daily press that I need not dwell on it. Our own children ask us about it. Your Society is engaged in formulating standards for this new technique.

The Society has recognized the serious need for improvement of picture and sound projection in the theaters, generally. You may have noticed from the press that about three weeks ago at the instigation of TOA (Theater Owners of America) there was formed a Council for Improvement of Theater and Motion Picture Projection. The SMPTE has volunteered its services to this Council for the instituting of an immediate educational campaign of theater operators for improvement of projection, sound and physical theater maintenance.

Last fall the Society formed an Ad Hoc Committee to Study the Responsibilities of the Society toward meeting the needs of Science and Education. This was prompted by the interest of our members in the passage by our Congress of the National Defense Education Act, possibly the greatest boon to public education in this country since the Land Grant Act of 1865. This committee, under the Chairmanship of John Flory, has been engaged in determining ways and means by which SMPTE can contribute to the program under the guidance of the Commissioner of Education in the Department of Health, Education, and Welfare of our government . . . . It is possible that engineers from SMPTE will be called upon to help plan the schoolroom of tomorrow, wherein each teacher will find his own personal effort enormously extended by the use of these audio-visual aids.

In recognition of the expanding field of instrumentation, and the large number of members of the Society who are workers in this field, the Board of Governors recently approved a change in the name of the High-Speed Committee, to The Committee on Instrumentation and High-Speed Photography. Aside from its engineering activities this committee has been diligently planning the Fifth International High-Speed Congress, which will meet in the Fall of 1960. I am pleased to announce that the general Chairman for this meeting will be D. Max Beard of the U.S. Naval Ordnance Laboratory and a member of the SMPTE Committee on Instrumentation and High-Speed Photography.

Among many other activities of the Society, there is the fine work continuing to be done by John Frayne's Committee on Education. At last count, approximately one thousand students had been taught in courses sponsored by SMPTE and, it should be added, taught by SMPTE members, at various accredited universities and colleges.

Your Board of Governors has recognized the need for reappraisal of the makeup of the Board itself, what with the large increase in membership and establishment of many new local sections of the Society. Consequently the standing Committee for Revision of the Constitution, Bylaws and Administrative Practices has been asked to study carefully the geographic allocation of Board representation to see if the Board of Governors correctly represents your Society. An Ad Hoc Committee has been appointed to consider many proposals received by the Board for changing the present schedule of membership grades and dues.

Our *Journal* continues to be one of the Society's major efforts. I would like to take this opportunity to thank publicly the editorial staff, and to mention especially Dr. Pierre Mertz, Chairman of the Board of Editors. Without his untiring efforts we don't know quite how we would manage.

I would like to welcome the Boston Section which is now about three months old and brings to eleven the number of local SMPTE Sections throughout the United States and Canada.

Thoughts on International Communication

By MITCHELL WOLFSON

(These excerpts are from the enlightening, but also entertaining, address at the May 4, 1959, Get-Together Luncheon of the Society at its Convention at Miami Beach. Mr. Wolfson gave a challenging address, "The Motion-Picture Industry," to the Society at its Hollywood Convention in April 1953 (May 1953 *Journal*, pp. 636-639). He is head of Wometco Television and Theatre Company. He speaks to the Society from a wealth of experience which has included the office of Mayor of Miami Beach from which he resigned to enlist in the U.S. Army in 1943; after service in England, Africa, France, Germany and Austria, he was discharged from the 6th Army Group at the end of the war as a lieutenant colonel.)

. . . As a native-born Floridian and a former Mayor of Miami Beach, I welcome you . . . in a spirit of appreciation for the challenge you have accepted for the future. . . . The theme of your Convention, "Films and Television for International Communication," poses both problems and possibilities . . . .

We may ponder this thought for a moment: We have reached a stage of technological development where only the radio signal, which includes television of course, when only this product of *your* development is capable of intercontinental travel which is faster than the world's weapons of destruction. We have increased our capability for destroying each other much faster than we have developed our ability to communicate with one another over the past decade.

It is fantastic to contemplate the catastrophe that could result in the trigger-happy world of today from just one simple blunder. . . .Can you imagine then the enormous value of having instruments by which the head of one state could be in immediate telecommunication with the head of another. To paraphrase an old proverb, here one picture might be worth 1000 ICBM's — and a hundred million lives. . . .

One of the items in your *Journal* in the last year was a map of the North Atlantic and Europe showing a plan for transatlantic television. . . . Actually, many of you probably believe that so far all this is just a scratching of the surface of the problem. . . .

There's a compelling fascination in the ideas with which you are working in automatic language translators. This is a project which should have not only the devoted attention you are giving it, but the attention of governments so that, through subsidy if necessary, it would have the dedicated effort of electronics experts everywhere . . . and we, the people of the world, would be assured of standardization from the outset. . . .

The word "ultimate" is one that has to be used with caution, but it would certainly come close to describing an efficient, dependable electronic language translator. . . .

I believe it would take perhaps a thousand years for all the peoples of the world to learn a common language. . . . A thousand years, and we don't even hope for that possibility. So you can see why I feel expansively encouraged at knowing that you are on the threshold of overcoming mankind's most frustrating and so far hopeless social inability to communicate our simplest and purest hopes and thoughts to all the different language speaking people of our world. . . .

If I seem to dwell on the language factor — the communication of ideas — rather than the physical establishment of an international television network, it is partly because I am not enough of an expert to get technical with you, though I have had some considerable experience in using your media to convey ideas; also, your own papers tell me that bridging the Atlantic with microwave relays, for example, can be accomplished with the greatest distance that has to be spanned only 290 miles. Just thirty miles south of Miami, at an elevation of almost zero, stand two 60-foot reflectors which comprise one end of a troposcatter relay which covers 185 miles . . . and which has been in successful operation since 1957, at Florida City just south of here. . . .

The Role of Motion Pictures

There is no known yardstick to measure the value, both commercially and idealistically, of the communications the American motion picture has established with the peoples of the world. It was announced just a week or so ago that the annual world film gross of the eight major producers alone had reached $590 million dollars. Of this amount, 310 million, or well over 50% of the studios' income, came from the foreign market. This is a tremendous acceptance from people who are not merely twirling a dial looking for something free, but who, by choice, are putting their hard-earned shillings, francs, marks, and lira on the counter.

This is a little recognized but extremely important tribute to American Democracy that is performed every day in the foreign countries reached by our films. You, and your predecessors, provided the technical excellence with which to tell a story, and it's to our everlasting national glory and gratification, that our purity of purpose — our intention only to entertain — has paid off so handsomely in supplemental benefits — not only to our economy, but to our national purposes and ideals as well. . . . American films are overwhelmingly preferred because they do the most honest job of entertaining; however, because they capture the attention of these people, the films also create an intense desire for American products. . . . People all over the world would still be scraping burned bread over the sink each morning if Hollywood hadn't sold them pop-up toasters. . . . It's small wonder that our Government is considering an increase of its support program for the showing of our films. . . .

But I don't want to dwell too long on the uses of the motion picture as an art form, as a political tool, and as a supersalesman. Your interest in motion pictures is as a science. . . .

In summing up my remarks on "Films and Television for International Communication" I would like to give you a comment which was made by Thomas Watson in *Forbes Magazine:* "With the proper flow of commerce across the borders of all countries, it is unnecessary for soldiers to march across those borders."

You people deal in scientific experiment — and as scientists, I salute you. But more than that, it is your work which will make possible the commerce that may prevent combat. Because you continue to bring the media closer and closer to perfection, you have created the two hottest merchandise movers in the world; and as you expand your services to reach greater numbers of the world's people, you will bring to all of us, to all mankind, an enrichment of both his purse and principles.

In closing, I would like to tell you of Albert Einstein's first comment after he had hit upon his profound equation, $E = MC^2$. He came downstairs in his sweatshirt and bedroom slippers and said, "Mama, I have a little new idea."

I can't exhort you gentlemen to come up with another $E = MC^2$. But your work is so terribly important that I do ask you, please, to come up with some little, little new ideas. The whole world is waiting to thank you.

Excerpts — Speeches at the Miami Beach Convention

The speech of welcome was delivered by President Norwood Simmons May 4, 1959, at the Get-Together Luncheon of the Society's 85th Convention. Mitchell Wolfson, President, Wometco Theatres, Inc., Miami, was Guest Speaker at the Luncheon. The special address by Major General John B. Medaris on Monday evening is planned for excerpting later for Journal *Publication.*

Evolution and Progress

By NORWOOD L. SIMMONS, *SMPTE President*

I BELIEVE . . . every delegate at this convention (felt it) a rare privilege . . . afforded him this week: A happier combination of opportunity to learn and a delightful place in which to do it cannot easily be imagined. Miami Beach is a lovely city — warm and gracious. . . . It is with much personal pleasure that I thank the members of our Board of Governors who several years ago voted that this convention be held in Miami Beach.

The manner in which our local members took command, once the decision was made to hold a convention here, and the tremendous effort which they have put forth, deserves our warmest thanks.

This convention is marked with an international flavor. It is the result of much effort by your Program Committee. Program Chairman Gar Misener, with special assistance from the local Associate Program Chairman Andy Beal, has assembled technical sessions of papers, many from outside the United States, covering the wide and timely interests of the Society. All the local arrangements and management of the week's show have been accomplished under Local Arrangements Chairman Norman Bean (see full story in news pages later in this *Journal*). . . .

We are particularly proud of the international equipment exhibit since it is the largest ever held by the SMPTE. . . .

The single word that best describes to me what has been going on in both our industry and our Society itself during the recent past is "evolution." In Hollywood we are witnessing a changing scene as the old-line major studios are gradually converting wholly or in part to television film production. There have been some rather drastic economic consequences of this shift. Instead of a continuation of the trend toward single ownership of all services and technical facilities that are needed in the making of a motion picture, we have seen a move toward establishment of specialized services of all kinds. Many studios have divested themselves of laboratory, sound department, camera department, and special-effects department. These operations have in many cases become commercial entities and offer their services on the open market, not only to the producer of films for entertainment, whether these be viewed in the theater or in the home on a TV set, but also to the producer of nontheatrical films. These shifts have increased the competition for the independent film producer's business. This results in more emphasis on good engineering practices. It means more opportunity for well-trained motion-picture and television engineers than has ever existed before.

Interest in many of the problems relating to the production of films for television is at fever pitch. This field is new enough so that engineers are pioneering in new techniques. Interest is reflected in the programs of our local sections and in the program content of this convention.

At the same time, there has been a tremendous growth in the use of the new, versatile technique, magnetic video recording. This method of recording TV programs has received such nationwide publicity in the daily press that I need not dwell on it. Our own children ask us about it. Your Society is engaged in formulating standards for this new technique.

The Society has recognized the serious need for improvement of picture and sound projection in the theaters, generally. You may have noticed from the press that about three weeks ago at the instigation of TOA (Theater Owners of America) there was formed a Council for Improvement of Theater and Motion Picture Projection. The SMPTE has volunteered its services to this Council for the instituting of an immediate educational campaign of theater operators for improvement of projection, sound and physical theater maintenance.

Last fall the Society formed an Ad Hoc Committee to Study the Responsibilities of the Society toward meeting the needs of Science and Education. This was prompted by the interest of our members in the passage by our Congress of the National Defense Education Act, possibly the greatest boon to public education in this country since the Land Grant Act of 1865. This committee, under the Chairmanship of John Flory, has been engaged in determining ways and means by which SMPTE can contribute to the program under the guidance of the Commissioner of Education in the Department of Health, Education, and Welfare of our government . . . . It is possible that engineers from SMPTE will be called upon to help plan the schoolroom of tomorrow, wherein each teacher will find his own personal effort enormously extended by the use of these audio-visual aids.

In recognition of the expanding field of instrumentation, and the large number of members of the Society who are workers in this field, the Board of Governors recently approved a change in the name of the High-Speed Committee, to The Committee on Instrumentation and High-Speed Photography. Aside from its engineering activities this committee has been diligently planning the Fifth International High-Speed Congress, which will meet in the Fall of 1960. I am pleased to announce that the general Chairman for this meeting will be D. Max Beard of the U.S. Naval Ordnance Laboratory and a member of the SMPTE Committee on Instrumentation and High-Speed Photography.

Among many other activities of the Society, there is the fine work continuing to be done by John Frayne's Committee on Education. At last count, approximately one thousand students had been taught in courses sponsored by SMPTE and, it should be added, taught by SMPTE members, at various accredited universities and colleges.

Your Board of Governors has recognized the need for reappraisal of the makeup of the Board itself, what with the large increase in membership and establishment of many new local sections of the Society. Consequently the standing Committee for Revision of the Constitution, Bylaws and Administrative Practices has been asked to study carefully the geographic allocation of Board representation to see if the Board of Governors correctly represents your Society. An Ad Hoc Committee has been appointed to consider many proposals received by the Board for changing the present schedule of membership grades and dues.

Our *Journal* continues to be one of the Society's major efforts. I would like to take this opportunity to thank publicly the editorial staff, and to mention especially Dr. Pierre Mertz, Chairman of the Board of Editors. Without his untiring efforts we don't know quite how we would manage.

I would like to welcome the Boston Section which is now about three months old and brings to eleven the number of local SMPTE Sections throughout the United States and Canada.

Thoughts on International Communication

By MITCHELL WOLFSON

(These excerpts are from the enlightening, but also entertaining, address at the May 4, 1959, Get-Together Luncheon of the Society at its Convention at Miami Beach. Mr. Wolfson gave a challenging address, "The Motion-Picture Industry," to the Society at its Hollywood Convention in April 1953 (May 1953 *Journal*, pp. 636-639). He is head of Wometco Television and Theatre Company. He speaks to the Society from a wealth of experience which has included the office of Mayor of Miami Beach from which he resigned to enlist in the U.S. Army in 1943; after service in England, Africa, France, Germany and Austria, he was discharged from the 6th Army Group at the end of the war as a lieutenant colonel.)

. . . As a native-born Floridian and a former Mayor of Miami Beach, I welcome you . . . in a spirit of appreciation for the challenge you have accepted for the future. . . . The theme of your Convention, "Films and Television for International Communication," poses both problems and possibilities . . . .

We may ponder this thought for a moment: We have reached a stage of technological development where only the radio signal, which includes television of course, when only this product of *your* development is capable of intercontinental travel which is faster than the world's weapons of destruction. We have increased our capability for destroying each other much faster than we have developed our ability to communicate with one another over the past decade.

It is fantastic to contemplate the catastrophe that could result in the trigger-happy world of today from just one simple blunder. . . .Can you imagine then the enormous value of having instruments by which the head of one state could be in immediate telecommunication with the head of another. To paraphrase an old proverb, here one picture might be worth 1000 ICBM's — and a hundred million lives. . . .

One of the items in your *Journal* in the last year was a map of the North Atlantic and Europe showing a plan for transatlantic television. . . . Actually, many of you probably believe that so far all this is just a scratching of the surface of the problem. . . .

There's a compelling fascination in the ideas with which you are working in automatic language translators. This is a project which should have not only the devoted attention you are giving it, but the attention of governments so that, through subsidy if necessary, it would have the dedicated effort of electronics experts everywhere . . . and we, the people of the world, would be assured of standardization from the outset. . . .

The word "ultimate" is one that has to be used with caution, but it would certainly come close to describing an efficient, dependable electronic language translator. . . .

I believe it would take perhaps a thousand years for all the peoples of the world to learn a common language. . . . A thousand years, and we don't even hope for that possibility. So you can see why I feel expansively encouraged at knowing that you are on the threshold of overcoming mankind's most frustrating and so far hopeless social inability to communicate our simplest and purest hopes and thoughts to all the different language speaking people of our world. . . .

If I seem to dwell on the language factor — the communication of ideas — rather than the physical establishment of an international television network, it is partly because I am not enough of an expert to get technical with you, though I have had some considerable experience in using your media to convey ideas; also, your own papers tell me that bridging the Atlantic with microwave relays, for example, can be accomplished with the greatest distance that has to be spanned only 290 miles. Just thirty miles south of Miami, at an elevation of almost zero, stand two 60-foot reflectors which comprise one end of a troposcatter relay which covers 185 miles . . . and which has been in successful operation since 1957, at Florida City just south of here. . . .

The Role of Motion Pictures

There is no known yardstick to measure the value, both commercially and idealistically, of the communications the American motion picture has established with the peoples of the world. It was announced just a week or so ago that the annual world film gross of the eight major producers alone had reached $590 million dollars. Of this amount, 310 million, or well over 50% of the studios' income, came from the foreign market. This is a tremendous acceptance from people who are not merely twirling a dial looking for something free, but who, by choice, are putting their hard-earned shillings, francs, marks, and lira on the counter.

This is a little recognized but extremely important tribute to American Democracy that is performed every day in the foreign countries reached by our films. You, and your predecessors, provided the technical excellence with which to tell a story, and it's to our everlasting national glory and gratification, that our purity of purpose — our intention only to entertain — has paid off so handsomely in supplemental benefits — not only to our economy, but to our national purposes and ideals as well. . . . American films are overwhelmingly preferred because they do the most honest job of entertaining; however, because they capture the attention of these people, the films also create an intense desire for American products. . . . People all over the world would still be scraping burned bread over the sink each morning if Hollywood hadn't sold them pop-up toasters. . . . It's small wonder that our Government is considering an increase of its support program for the showing of our films. . . .

But I don't want to dwell too long on the uses of the motion picture as an art form, as a political tool, and as a supersalesman. Your interest in motion pictures is as a science. . . .

In summing up my remarks on "Films and Television for International Communication" I would like to give you a comment which was made by Thomas Watson in *Forbes Magazine:* "With the proper flow of commerce across the borders of all countries, it is unnecessary for soldiers to march across those borders."

You people deal in scientific experiment — and as scientists, I salute you. But more than that, it is your work which will make possible the commerce that may prevent combat. Because you continue to bring the media closer and closer to perfection, you have created the two hottest merchandise movers in the world; and as you expand your services to reach greater numbers of the world's people, you will bring to all of us, to all mankind, an enrichment of both his purse and principles.

In closing, I would like to tell you of Albert Einstein's first comment after he had hit upon his profound equation, $E=MC^2$. He came downstairs in his sweatshirt and bedroom slippers and said, "Mama, I have a little new idea."

I can't exhort you gentlemen to come up with another $E = MC^2$. But your work is so terribly important that I do ask you, please, to come up with some little, little new ideas. The whole world is waiting to thank you.

news and reports

Papers Program for the 86th Convention, October 5–9, 1959, Statler Hilton Hotel, New York

Theme: *Motion Pictures and Television in the Space Age*

86th Convention Program Chairman: **J. Paul Weiss,** Du Pont Photo Products Dept., Parlin, N.J.

TOPICS AND TOPIC CHAIRMEN

Symposium on Film Steadiness: GORDON A. CHAMBERS, Eastman Kodak Co., 343 State St., Rochester 4, N.Y.

Cinematography: HERBERT E. BEHRENS, E. I. du Pont de Nemours & Co., Photo Products Dept., Parlin, N.J.

Space Technology and Image Sensing: SIDNEY STERNBERG, Radio Corp. of America, Astro-Electronics Products Div., Princeton, N.J.

Photography — Laboratory Practices: PAUL A. KAUFMAN, Du-Art Film Laboratories, Inc., 245 W. 55 St., New York 19.

Photography — Sound Recording and Reproduction: EDWARD SCHMIDT, Reeves Soundcraft Corp., Great Pasture Road, Danbury, Conn.

——, Instrumentation and High-Speed: CHARLES W. WYCKOFF, Edgerton, Germeshausen & Grier, Inc., 160 Brookline Ave., Boston, Mass.

International Television: ELLIS W. D'ARCY, Box 1103, Ogden Dunes, Gary, Ind.

Television — Equipment and Practices: RALPH N. HARMON, Westinghouse Broadcasting Co., 122 E. 42 St., New York 17.

——, Scientific and Military Uses: GEORGE GORDON, Tarc Electronics, Inc., 48 Urban Ave., Westbury, L.I., N.Y.

——, Recording (including video tape): ROSS H. SNYDER, Ampex Corp., 934 Charter St., Redwood City, Calif.

Deadline for Abstracts: July 27. *Procrastination is the thief of time.* It is customary for pre-convention announcements to contain an appeal to authors to be prompt in submitting Author Forms to the Topic Chairmen. Such insistence may seem a little overemphatic, perhaps bordering on nagging. There are, however, good and sufficient reasons for such reiteration. The foundation stone — indeed, the raison d'être — of each Convention is the Papers Program. It is distressing to all concerned when an excellent paper is submitted too late to be properly scheduled in the Program. After the deadline has passed, it may still be possible for a paper to be included by special arrangement by the Program Chairman or by the Papers Committee Chairman; but such arrangement is, at best, an emergency measure.

Special Note to Authors: The Topic Chairmen have a considerable load of responsibility that becomes heavier as the Convention approaches. It is important that no unnecessary difficulties be created. Sometimes, of course, there are delays that could not possibly be avoided, but it is important that by individual and collective effort last-minute crises be kept to the minimum. Submitting Author Forms as early as possible is one way of cooperating with the Convention effort.

Occasionally someone unfamiliar with publication procedures for the *Journal* has the impression that a paper presented at a Convention is thereby automatically accepted for publication in the *Journal*. Although most Convention papers are eventually published in the *Journal*, the format of a paper suitable for oral presentation is not usually suitable for publication in the *Journal*. Incidentally, the deadline for the "reading" manuscripts is September 4, 1959, when they should reach Society Headquarters.

Another item of interest for authors concerns the papers which may seem entirely unrelated in subject matter to the Convention theme. It is one of the duties of the Program Chairman to study these "homeless" manuscripts and determine the topics under which they can best be sheltered. An author should not hesitate to submit a manuscript even though it may seem, to him, too far afield from Convention topics.

General Comment: The theme of the 86th Convention is a dramatic expression of the vital role of the Society in a world that has changed almost beyond belief in less than a half-century. Although the idea of applying the techniques of photography and television to the exploration of space is still startlingly new, the techniques themselves have been slowly developed over the years by members of the Society. Its interest in high-speed photography which was officially expressed in 1948 with the formation of an engineering Committee on High-Speed Photography foreshadowed its role in the near future when the pioneering spirit has urged Man out to the moon and even greater distances. The 86th Convention may well be one of the most exciting and significant of the many important Conventions held over the years.

Work for this Convention is already going forward with much preliminary planning and preparation accomplished — by Papers Committee Chairman Ben Plakun and Editorial Vice-President Glenn Matthews. The Regional Chairmen of the Papers Committee (April *Journal*, p. 247), appointed for their special qualifications, are engaged in the dedicated, and sometimes drab and difficult, work that is necessary to the success of the Convention. The world-wide influence of the Society is ably represented by the overseas Chairmen in 19 countries whose efforts have done so much for recent Conventions.

Suggestions about papers or papers prospects are, of course, welcome at any time. Suggestions can be submitted to the Program Chairman, or to the Editor at Society Headquarters. — *R.H.*

Exhibit

Those who were at the last convention held in New York, in 1956, will recall the spacious and convenient layout of the exhibit which was an outstanding attraction of that convention. This year, the display booths will again be set up in the large, light Penn Top, 18 floors above Manhattan and adjacent to the sessions auditorium and the registration area in the Statler Hilton.

There will be just 47 booths available, and advance orders for space are already coming in. If you have not already received full details and order forms in the mail, and intend to exhibit your equipment or services to the industry at the New York convention, get in touch without delay with the Exhibit Chairman, William J. Reddick, c/o W. J. German, Inc., Jane St., Fort Lee, N.J., or call LOngacre 5-5978 — *D.C.*

The 85th Convention, Miami Beach

THE THEME of the 85th Convention, *Films and Television for International Communication*, is an impressive reminder of the Society's ever-widening area of interest and responsibility in a changing world, a reminder which received special emphasis in the Thursday Morning Session on "Multilingual Films," and which was reflected in the dynamic approach to contemporary problems manifested in the Papers Program and discussions.

Although the papers were fewer than for recent Conventions, they conformed to a high standard of quality in content, presentation and timeliness. Credit for a polished performance and overall effectiveness of the entire program is due Program Chairman Garland C. Misener, and Associate Program Chairman C. Henderson Beal.

The international interests of the Society were also happily illustrated by the presence on the Program of members from Argentina, Canada, Cuba, England, Italy and Mexico.

Topic Chairmen

The Society's Convention Programs in recent years have been developed by a slate of subject area chairmen who assist the Program Chairman and work across the geographic lines of the Papers Committee Regional Chairmen (p. 247 of the April 1959 *Journal*). The Topic Chairmen for the Miami Beach Convention were:

Dr. Sydney W. Head – *Audio-Visual Communications*
Dr. John Storr – *Cinematography*
Lincoln L. Endelman, assisted by Gaver M. Powers – *Instrumentation and High-Speed Photography*
Harold Jones – *Laboratory Practice*
Max G. Kosarin – *Multilingual Films*
Boyce Nemec – *Sound Recording and Reproduction*
Philip M. Cowett – *Standards and Standardization*
George H. Gill – *Studio Lighting and Practices*
Glenn H. Dorsey – *Television: Broadcast and International Facilities*
M. Peter Keane – *Television: Film Techniques*
John L. Koushouris – *Television: Recording*
Willy Borberg – *Theatres and Projection*

The Advance Program in the March *Journal* was essentially the Final Program; but there were some changes as usual when the show went on. Copies of the Final Program are available from Society headquarters. Changes from it were:

On Monday afternoon's Laboratory Practice session, "Setting up a Cinematographic Department and Color Laboratory in Cuba" by Pablo Epstein was not delivered.

On Tuesday morning's Audio-Visual Communications Session, the paper "Professional Motion-Picture Training, Liberal Education and the Communication Arts Curriculum" by A. Nicholas Vardac and the related Symposium Discussion were canceled.

On Friday morning's Television Facilities Session, "A Program-by-Program Billing System for Pay TV" by K. A. Simons was withdrawn.

On Friday afternoon in the session on Television Recording a paper was added: "The Ampex Videotape Recorder and Its Performance on Foreign Television Standards" by Kurt R. Machein.

Format of the Convention

The arrangement made by Chairman Misener for the fewest compromises and critical conflicts began with a high-speed photography papers session on Monday morning. Attendance during the session ranged from 110 to 160. Some sessions, depending on the subject, had average attendances of 50 to 60; others ranged around 100; 250 were on hand for the film *Nautilus Under the North Pole;* some 400 heard Gen. Medaris on Monday evening; and an average of over 100 attended Friday afternoon's television recording session.

The traditional (for some 20 years) Get-Together Luncheon was graced by Mitchell Wolfson who, from his interests both motion-picture theaters and in television stations, addressed the Society with pertinent thoughts on communication, internationally and in general. The highlights of Mr. Wolfson's message appear on earlier pages of this *Journal*.

In the afternoon nine papers comprised a session on laboratory practices.

Major General John B. Medaris, Commanding General, U. S. Army Ordnance Missile Command, gave an instructive and sobering exposition on Monday evening as to where we then stood in space. Excerpts of his address are being planned for later publication. Television and newspaper interest was extensive: the General's press conference was telecast by the three TV stations in Miami, broadcast by the radio stations and carried across the country by the two major wire services. General Medaris forecast at this time what later proved the trip to and from outer space by the monkeys Able and Baker.

Guest speaker Mitchell Wolfson.

Major General John B. Medaris explains a point to SMPTE President Norwood Simmons.

Although the seriousness of the Monday evening session was wholly in keeping with convention technical sessions, the occasion was lightened for a moment by the reading of a "poem" allegedly written by one of the engineers working on the missile project:

Medaris, Von Braun and Me

In the missile game we've won great fame
The world knows our Jupiter-C
And what we've done with Explorer I
Medaris, von Braun, and me.

Oh watch our smoke as we go for broke
To solve the space mystery
We have a thirst to be there first
Medaris, von Braun, and me.

Our skill we pride, we'll travel wide
Into space so wild and free
To the moon, then Mars, then to distant stars
Medaris, von Braun, and me.

When finally we've planned a space ship that's manned
And they call for brave men — two or three
To try first for the moon in that metal balloon
Call Medaris and von Braun — NOT ME.

Programed on Tuesday morning was a third session on high-speed photography, appropriate for this convention held so near Patrick Air Force Base and Cape Canaveral. Tuesday afternoon was a new type of session, described below along with the Equipment Exhibit to which it was related. On Tuesday evening a session on cinematography and projection was the final technical session to be held during an evening.

The Society's interest in education and its policy of encouragement of its younger members were exemplified by a paper presented at the Monday Afternoon Laboratory Practices Session, "Student-Built 16mm Positive Film Processor," by John C. Stormont, a student at the University of Miami. The Society's educational interests were also reflected in papers presented at the Tuesday Morning Session on Audio-Visual Communications, held concurrently with the high-speed photography session. The Session was especially well arranged to pre-

Loris M. Gardner and George Lewin are attentive as Max Kosarin explains the operation of the Multivox recorder.

Irving Ewig welcomes guests to the L. B. Russell Chemicals Coffee Shop.

sent a comprehensive picture of the various directions in which television and audio-visual technique are going. Some of the fields of application described in the papers include military training, community and adult education, and college courses. A paper by C. Walter Stone, of the Federal Office of Education, on "Education for Tomorrow," analyzed the National Defense Education Act of 1958 with references to concepts of audio-visual communication.

Concurrent sessions were scheduled on Wednesday morning: ten papers on sound subjects; five papers in a session on studio lighting and practices. Wednesday evening was devoted to the Banquet and Dance.

Thursday morning's session, Multilingual Films, contained four papers and also the films and demonstrations noted later below. An interesting paper on "International Use of Educational Films" was presented by Miguel Pereyra, Telesistema Mexicano S.A., Mexico City. Sr. Pereyra also graciously served as Vice-Chairman of the Thursday afternoon papers session. Thursday afternoon was a session of six papers on television film techniques. Thursday evening was kept "open."

All day Friday was devoted to television: eight papers on facilities in the morning and nine papers on television recording in the afternoon. The final paper described the Ampex Mobile Videotape Recording System.

Demonstrations and Films

The live show values of a convention are important: seeing people, seeing equipment, seeing how things have been done and seeing films. Especially important in this regard were these technical demonstrations and related papers.

"Audio-Visual Communications in Missile Training" by Col. H. S. Newhall, Commandant, U. S. Army Ordnance Advance Guided Missile School, Redstone Arsenal, Ala. Col. Newhall gave a special presentation with an impressive arrangement of projectors, television units and TelePrompTers.

"A High-Speed Color Negative Film" by Dr. Merle L. Dundon of Eastman Kodak Co. was enhanced by the projection of demonstration prints.

"Simultaneous Theater Reproduction of Four Languages," Part II of this paper showed the use and demonstration of Multivox equipment and some of the special films prepared for use at the Atoms for Peace Conference at Geneva.

"A Mobile Videotape Recording System," a paper by J. Byrne Hull and H. G. Hummel of Ampex Corp., described the full-sized cross-country type bus (Videotape Cruiser) parked at the Convention Entrance of the hotel during the entire week. Video pictures were shown in the Cruiser as they had been made on Videotape while cruising in Miami.

Also, available for inspection at the Convention was WTVJ's television remote pick-up van with a full complement of cameras and associated equipment, ingeniously installed.

At the Local Arrangements Dinner. Left to right: Garland C. Misener, C. Henderson Beal, George Gill, Norwood L. Simmons, Mrs. Garland C. Misener, Convention Bureau representative, Mrs. Norwood L. Simmons, Larkin C. Webb, Mrs. Reid H. Ray, Charles S. Stodter, Mrs. George Gill, Norman Bean, Denis A. Courtney, Allan Nolte (Fontainebleau Hotel), Redstone Arsenal representative, William J. Reddick, Reid H. Ray.

C. Henderson Beal, Assistant Program Chairman, at the Coffee Shop.

One aisle of the Equipment Exhibit, showing approximately half of the 41 booths on display.

Films represent an integral and very important part of each Convention. Besides those already mentioned, a film feature was "Photography of Atlantic's Farthest Shores" by Newman Bumstead of the National Geographic Society who gave a nontechnical commentary of how he shot the sections of movies shown.

A most outstanding film, *Nautilus Under the Pole*, was specially scheduled Monday afternoon. It showed man's first voyage of discovery under the North Pole. Photographed in 35mm Eastman Color, it was produced by the Naval Photographic Center.

The Ampex Videotape Cruiser attracted a steady stream of visitors.

Another film not scheduled in the printed program was *On Target*, the story of the flight test of the Atlas AFICBM, courtesy of Convair-Astronautics, a division of General Dynamics Corp., a 28-min 16mm sound film in color.

Motion-Picture Short Subjects Chairman James A. Moses had a full schedule of appropriate films listed in the Final Program to provide this important part of the program for registrants.

Equipment Exhibits and Session

The area used for the exhibit was the only part of the Fontainebleau's new convention facilities that was ready for use by the time the convention opened, and that by the narrowest possible margin. Two days before the equipment was due to be moved in work was being finished on the floor and glass was going into the windows. One end of the room, as yet unbuilt, was protected from the blue Florida sky by a temporary wall. Yet the combination of hard work and good cooperation contributed by the hotel management and the display company resulted in one of the smoothest-run and best looking exhibits the Society has had. The area was completely filled by 41 booths of highly varied and interesting equipment assembled from the U.S., England, France, Switzerland and Germany.

The following companies displayed equipment to an audience of more than 700 exhibit visitors during the week:

Ampex Corporation
Animation Equipment Corporation
Bell & Howell Company
Benson-Lehner Corporation
Birns & Sawyer Cine Equipment, Inc.
Camera Equipment Company
Century Lighting, Inc.
Société de Gérance des Etablissements Cinématographiques Eclair
Electronic Applications, Inc.
Flight Research, Inc.
Florman & Babb, Inc.
The Harwald Company
Hollywood Film Company
Houston Fearless Corporation
Kling Photo Corporation
Lipsner-Smith Corporation
Magnasync Manufacturing Co. Ltd.
D. B. Milliken Company
Motion Picture Enterprises, Inc.
Moviola Manufacturing Company
Paromel Electronics Corporation
Perfectone S.A.
Precision Laboratories
Prestoseal Manufacturing Corporation
RCA Film Recording
Ro-Nan Plastic & Manufacturing Company
S.O.S. Cinema Supply Corporation
Studio Supply Company
Time Automated Manufacturing Co., Inc.
Unicorn Engineering Corporation
Vicom, Inc.
Wollensak Optical Company
Zoomar, Inc.

An innovation at this convention was the Equipment Papers and Demonstrations Session, held on Tuesday afternoon, at which exhibitors presented ten-minute papers describing new equipment, and/or demonstrated the equipment itself. Since this was the first time such a session had been arranged, much valuable experience was gained in the mechanics of organizing and staging it to the best advantage, which should make this feature a more valuable opportunity for exhibitors and audience alike at future conventions. Great credit for improvising and running it goes to Jim Wassell, of Bell & Howell, who undertook the job on short notice, and to Harry Teitelbaum, of Hollywood Film Co., who ably assisted him.

An unfortunate conflict of dates kept Exhibit Chairman John Olsson away, but the Assistant Chairman, George Gill, and the indefatigable Reid Ray filled the gap more than adequately and gave the Society one of the finest exhibits it has ever had.

The Coffee Shop, an SMPTE Institution since RCA began it at the Lake Placid Convention in 1950, was sponsored in fine style at the Fontainebleau by L. B. Russell Chemical Co., with Irving Ewig as host. It was one of the best attended hotel sites, especially before and after sessions.

The Miami Location

At this, the first convention for SMPTE in the southeast area of the U.S., many special benefits obtained. With the international aspect a strong one in the papers program, there were natural bridges for local visits.

When Channel 12 was set up in Havana as a color TV station depending exclusively on film for its programing, Telecolor was set up as its cinematographic branch. Delegates to the Convention were invited to visit the Havana Hilton Hotel which houses the station, by Gaberiel Casanova, General Manager of CMBJ-TV, and also Telecolor, of which Raul Amado Blanco is Manager.

Mr. Goar Mestre, President of Circuito CMQ, S.A., extended an invitation to visit Radiocentro in Havana, including CMAQ-TV. Members who were able to accept Mr. Mestre's gracious hospitality were impressed by the excellent equipment and up-to-date facilities. Other Havana stations, including CMBF-TV, Channel 4, extended similar invitations.

Before the Convention, Program Chairman Misener visited Havana and was welcomed by a committee of four: Eduardo More of Circuito CMQ; Pedro E. Misner of Siboney Advertising; Raul A. Blanco, Manager of the Telecolor film laboratory; and Pablo Epstein of Telecolor.

Besides the University of Miami, just a bit to the south, there was Patrick Air Force Base several hours to the north. A special Post-Convention tour of the Base's photographic facilities and laboratory was arranged by Major General Donald N. Yates, Commander of the Air Force Missile Base. General Gates was present on Monday evening at our Convention as a special guest of the Society. A caravan of hired autos left the Fontainebleau early on Saturday for Patrick. The group was briefed on the activities of the base by Major James F. Reid, Chief, Community Relations Branch, Patrick Air Force Base, and by Major Roy Jarman, Technical Service Laboratory. Slides and motion pictures were shown of rocket and missile firings and of the plan of the processing laboratory.

Norman Bean, Local Arrangements Committee Chairman.

Local Arrangements

It is an axiom that no Convention can be a success without the devoted efforts of many behind-the-scenes workers. Although the local Arrangements Chairman, Norman Bean, had the intangible aid of the Florida climate in making this Convention a memorable one, the intangibles alone would have meant nothing without his earnest labors. Others who deserve more than a word of congratulation for their able handling of Convention details are George H. Gill, Hotel Arrangements and Assistant Exhibit Chairman; William J. Reddick, who was responsible for the smooth running of the Registration process; Bert Toppan, who handled Publicity; and Spears Mallis, who controlled the myriad details of the Luncheon and Banquet arrangements. The famous hospitality of Miami Beach was exemplified in the person of Edmund Read, Hospitality Chairman. The Ladies Program was in the capable hands of Mrs. George Gill. Earl Lewis, Local Membership Chairman and Auditor Arthur Hertz ably performed their demanding tasks. Projection and recording facilities were provided by Larkin C. Webb Projectionist Corp. Administrative Assistants Ralph Schneelock, Jr. and Harold Hornstein conscientiously fulfilled their duties.

Society Business and Committee Meetings

Convention time is no time for any priorities but SMPTE business for the Officers, Board of Governors, and standing and local Chairmen.

On Friday evening before a convention, the Local Arrangements Chairman and the Convention Vice-President call all hands together for a run-through of one thousand and one items accomplished or still open.

The Board of Governors meets before the Convention, usually for a full day's business and usually on Sunday. Reflections and results from these meetings appear in the SMPTE President's Monday Noon speech at the Get-Together Luncheon. These reports have been restyled and made slightly more formal and published in the *Journal* biannually in recent years.

Often amounting to almost another whole convention by itself is the schedule of committee meetings, particularly for engineering. Six of the engineering committees met at Miami Beach to consider technical specifications to be included in proposed American Standards and SMPTE Recommended Practices. As a result of the committee discussions several items of old business were resolved and many new projects were added to the committees' program of work.

Besides engineering and standardization matters, administrative (especially convention and exhibit planning) and editorial meetings are manifold. Well attended sessions were held of the Papers Committee, Board of Editors and Publications Advisory Committee. About 20 persons joined together for the Publications Luncheon on the beautiful terrace dining room facing the formal gardens of the Fontainebleau.

SMPTE Test Films

Test films planned by the Society's technical committees and produced under the Society's exact supervision are available from the headquarters office at 55 West 42 St., New York 36. Catalogs containing brief descriptions of each film are obtainable on request.

These films are used by manufacturers for testing the performance of new equipment, by television station technicians for lining up and adjusting film pickup systems, by maintenance men for "in service" maintenance of projectors and sound equipment, and by dealers for testing and demonstration equipment.

Films are available in the following categories.

Television — Picture Only, Color or Black-and-White
CinemaScope
Visual 35mm — Picture Only
Magnetic — 16mm Sound Only
Picture and Sound — 16mm
Picture Only — 16mm
Glass Slide — 16mm

Membership Certificates (Active and Associate members only). Attractive hand engrossed certificates, suitable for framing for display in offices or homes, may be obtained by writing to Society headquarters, at 55 West 42nd St., New York 36, Price: $2.50.

NEW Houston Fearless Color Labmaster

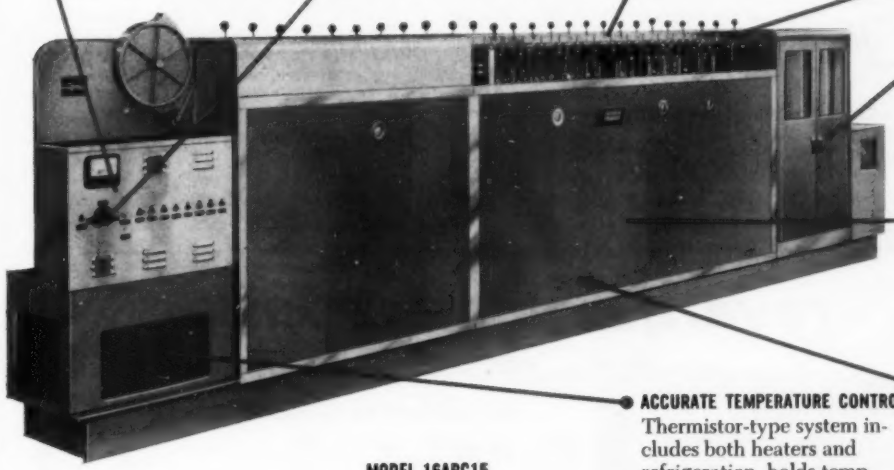
Faster! Better! Easier! Color Film Processing

SIMPLIFIED OPERATION
Automatic controls minimize need for personal supervision. Requires minimum of training.

ELECTRONIC SPEED CONTROL
Film transport speed control is provided by variac regulation of motor for greater accuracy.

UNIFORM FILM TENSION
Exclusive H-F clutch drive maintains uniform film tension, eliminates film breaks.

ADJUSTABLE LIFTER RODS
Indicate position of elevator in each tank, permit fine adjustment of time in solutions.



EFFICIENT DRY BOX
Utilizes filtered air warmed by fin-strip heaters. Adjustable to low, medium & high.

STAINLESS STEEL TANKS
All tanks are type 316 stainless steel with bottom drains. Accurate temperature indication provided.

ACCURATE TEMPERATURE CONTROL
Thermistor-type system includes both heaters and refrigeration, holds temp. to within $\pm 1/4°$

TURBULATION PUMPS
Developer and bleach tanks have turbulent washes. Pumps are chemical-resistant, trouble-free.

MODEL 16ARC15

COMPLETE AUTOMATION of color film processing is accomplished with the NEW Houston Fearless Color Labmaster . . . making it possible to process more film in less time — with less personal supervision — and assuring consistently high quality results. Available in three basic models: For 16mm Ektachrome (7255) and Anscochrome; 16mm Anscochrome; 16/35mm Anscochrome. Processing speeds up to 75 feet per minute.

Completely self-contained, daylight operating. Highly experienced engineering, the finest available materials and precision craftsmanship produce a rugged, efficient, thoroughly dependable machine. Volume manufacturing permits pricing the Color Labmaster most reasonably. Send coupon now for catalog and prices. *For 31 years Houston Fearless has been the leading manufacturer of motion picture film processors, your assurance of parts and service availability.*

HOUSTON FEARLESS

HOUSTON FEARLESS CORPORATION
11827 West Olympic Blvd., Los Angeles 64, California

Send catalogs and prices on ☐ Color Labmaster processors. ☐ B & W processors. ☐ Camera heads. ☐ Remote Control heads. ☐ Tripods. ☐ Dollies. ☐ Pedestals.

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

Education, Industry News

The International Exhibition of Technical, Industrial and Agricultural Films, an annual event, will take place this year October 21-25 at Rouen, France. Films in the following categories will be screened: research, human relations, training, accident prevention and safety, industrial techniques, product documentaries, industrial magazine, prestige, motion-picture techniques and audio-visual aids. For complete details, write to: Secrétariat Permanent des Journées Internationales du Film Technique, C.O.M.E.T., Quai de Paris, Rouen (S.Mme), France.

The 13th Congress of the International Scientific Film Association will be held in London and Oxford Sept. 23 to Oct. 2, 1959. Films submitted for showing at the Congress must have been completed since March 1, 1958, and must not have been shown at any previous Congress. Subject categories include the film in research and specialized techniques; in teaching and training, and for the popular representation of Science, Industry and Medicine. Further information is available from Scientific Film Assn. of Great Britain, 3 Belgrave Square, London S.W.1, England.

Seven organizations in the audio-visual field have announced the dates of their forthcoming meetings in connection with the 1959 Audio-Visual Convention at the Hotel Morrison in Chicago. They are: Educational Film Library Assn, July 24–26; AV Workshop for Industrial Training Directors, July 27; Assn. of Chief State School AV Officers, July 26–28; Agricultural Audio-Visual Workshop, July 27–28; AV Conference of Medical and Allied Sciences, July 27; Religious AV Workshop, July 26; National Audio-Visual Assn, July 25–28. An estimated total of 117 manufacturers and producers will participate in the National Audio-Visual Exhibit, July 25–28. Products to be displayed include projectors, recorders, language laboratory equipment, high-efficiency projection screens, daylight control equipment, educational TV equipment, and other audio-visual equipment.

"Requirements of Space Age Technology" is the theme of the Convention of the Society of Photographic Instrumentation Engineers to be held in Los Angeles, Aug. 4–6. Twenty-three sessions are scheduled. An Exhibit of precision instruments will be held in conjunction with the Convention. Post-convention tours to Mexico City and Acapulco can be arranged. Further information is available from Office of the Secretary, A. J. Carr, Box 288, Redondo Beach, Calif.

New York University's Summer Motion Picture Workshop (July 27 – Sept. 4) is an intensive six-week workshop in professional production, direction and writing. It is primarily for advanced students in the University's Dept. of Television, Motion Pictures and Radio, special students, teachers, and persons professionally engaged in the field. Workshop emphasis is on creative film-making. Films are produced in the University's studios and on location. Lectures by distinguished filmmakers are an integral part of the Workshop. Field trips to New York motion-picture and TV studios are arranged. Requests for information should be addressed to Dept. of Television, Motion Pictures and Radio, New York University, Washington Square, New York 3.

Blue Ribbon Awards were presented during the American Film Festival to approximately 35 16mm films and 12 film strips in a variety of subject categories. Inaugurated this year by the Educational Library Association, the Festival is the first event of its kind since the discontinuance of the Golden Reel Awards. A total of 250 16mm films and 75 film strips in 34 categories competed for the awards. The competing films and film strips were selected by pre-screening committees. Among the prize-winning films of general interest are; *Watershed Wildfire* (in the category of Agriculture, Conservation and Natural Resources) produced by the Motion Picture Service of the U.S. Dept. of Agriculture; *City of Gold* (History and Biography) produced by the National Film Board of Canada; *The Melbourne Olympic Games* (Sports, Physical Education and Recreation) produced by Jam Handy Organization; *A Dancer's World* (Music, Dance, and Pantomime) produced by

reverberation missing?

EMT 140 Highlights:

- 0.8 to 5 seconds instantly selectable
- Effect!
- No coloration (This is a natural)
- Minimum volume for maximum reverberation
- Easy 600 ohm insertions (zero loss)
- Minimum maintenance (tube changes)

Write for a free copy of Dr. Kuhl's article describing technical and acoustical wherefores, and send us a tape containing samples upon which we will place some reverberation.

electronic applications, inc., 194 Richmond Hill Ave., Stamford, Conn.

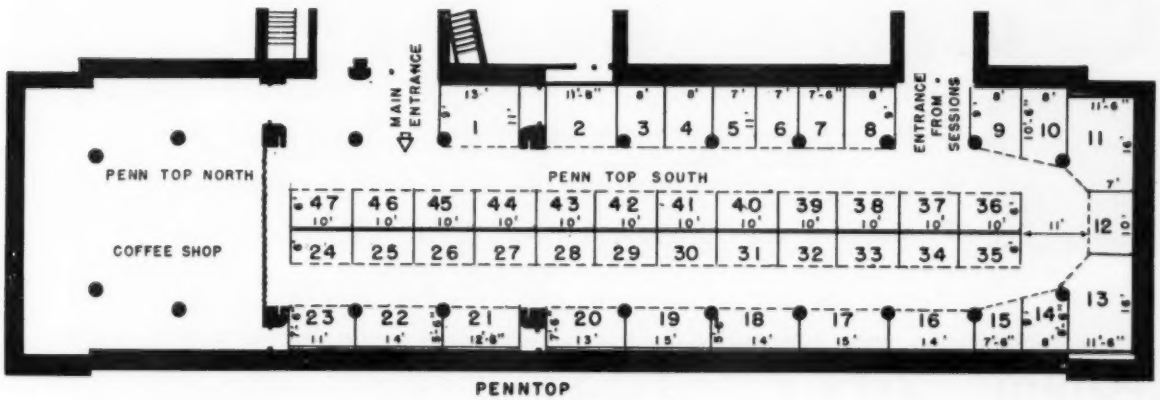
Viditon Corporation Limited, 384 Bank Street, Ottawa 4, Canada

In Chicago: Ray R. Hutmacher Associates, Inc., 6647 N. Oliphant Ave., Chicago 31, Illinois
In Dallas: Audio Acoustics, 130 Fairview Drive, Arlington, Texas
In Los Angeles: Ralph Auf der Heide, P. O. Box 201, Altadena, Calif.
In Miami: Dukoff International Sound Corp., 1625 Bay Road, Miami Beach, Fla.
In New York: Harvey Radio Co., 103 West 43rd Street, New York
In San Francisco: Ron Marco, 2880 Ridgeway Avenue, San Bruno, Calif.

NEW YORK CONVENTION EXHIBIT

The newest developments in equipment, materials and information contributing to the future of the industry. See the latest advances in . . .

- cameras
- projection equipment
- magnetic/optical sound devices
- studio and projection lighting
- motion-picture processing and lab equipment
- editing-room equipment
- instrumentation and high-speed photography
- closed-circuit TV equipment
- laboratory services
- special effects
- production techniques



BOOTH RENTAL RATES

BOOTH NO.	
1	$600
2	460
3–7	360
8, 9, 16–19, 22	425
10, 20, 21	400
11, 13	550
12, 45–47	375
14, 15, 23, 36–38	350
24–35, 39–44	330

RESERVATIONS for booth space are now being made by the Exhibit Committee Chairman: William J. Reddick, c/o W. J. German, Inc., Jane Street, Fort Lee, N.J.

86th SMPTE SEMIANNUAL CONVENTION

STATLER HILTON HOTEL, NEW YORK

Exhibit Open October 5 thru 8

Nathan Kroll; *The Wonderful World of Wash 'N Wear* (Sales and Promotion — Agriculture, Construction, and Textiles) produced by Jam Handy Organization; and *Fire and the Wheel* (Institutional Public Relations — Commercial Organizations) produced by Parthenon Pictures. Film strips of special interest included *The Battle for Liberty* (Social Studies) produced by Jam Handy Organization; *The Epic of Man* (History) produced by Life Filmstrips; and *The Earth and Its Moons*, (Science) produced by Films for Education.

New sustaining member of the Society is the Association of Professional Cinema Equipment Dealers, an organization created last year for the purpose of mutual understanding and ethical conduct within the industry. The organization also voted sustaining membership in the Film Producers Association. APCED members are: Camera Equipment Co.; Camera Mart Inc.; Florman & Babb; National Cine Equipment Inc., and S.O.S. Cinema Supply Corp. This New York group handles only professional equipment. Rental equipment to a value of $2 million is available from the associated dealers.

The resignation of Y. Frank Freeman as head of the Paramount Studio for reasons of health was announced May 17. Associated with Paramount for 26 years and head of the studio for more than 20 years, he will remain a vice-president of the company and will act in an advisory capacity. Mr. Freeman has been a helpful friend to the Society and to the many persons who have been associated with him. The usually "hardboiled" *Hollywood Reporter* said, "Mr. Freeman was one of the nicest, kindest, fairest and most scrupulously honest executives who ever headed up a major plant in Hollywood . . . the industry he so long has served — and to which he invariably gave such sagacious counsel over the years — continues to need him."

Rodney D. Chipp, Director of Engineering of ITT Communication Systems, Inc., and his wife, Dr. Beatrice A. Hicks, President of Newark Controls Co., Bloomfield, N.J., have been chosen by the National Society of Professional Engineers, headquarters, 2029 K St., Washington 6, D.C., to represent American engineers on a goodwill tour of South America. Purpose of the tour is to meet with key people in the various South American countries to discuss solutions to, or prevention of, problems resulting from interpersonal relationships complicated by language barriers and contrasting national customs. They will also inspect as many as possible of the most important engineering developments in the countries they visit. Upon their return they will present a report to the NSPE which will be part of a long-range program to equip engineers and technicians to deal with social and cultural differences between the United States and other parts of the world.

Hazard E. Reeves, President of Reeves Sound Studios, Inc., is the recipient of the first annual Industry Achievement Award presented by the Film Producers Association of New York. Mr. Reeves is also President of Reeves Soundcraft Corp., Cinerama, Inc., and is an officer of other corportions in the motion-picture field. The Citation accompanying the Award stated, "In recognition of outstanding accomplishment in advancing the prestige of the motion-picture industry of New York and its continuing growth as a center of motion-picture arts and sciences."

The appointment of Charles L. Townsend as Director, Television Engineering of TelePrompTer Corp. has been announced. Prior to his present appointment, Mr. Townsend had been associated with National Broadcasting Co. for more than 20 years where he served, for the past five years, as Manager, Film and Kinescope Operations. He is the author of a number of professional papers and articles on TV standards and network operations, including an NBC publication, *Specifications for Motion Pictures for TV Transmission*, widely used as a reference. He is a Fellow of this Society, and his memberships in other organizations include Electronic Industries Assn., and IRE.

Elias J. Drexler has been appointed Manager of the Professional Motion Picture Dept. of Gevaert Co. of America, Inc. In his new position he will be responsible for sales in the United States of films and magnetic tape. He will be assisted by Chris Thiers.

Educators . . .

- Make sure you get the most out of your 16mm sound films
- Use the standard tests your own projector repairman uses
- Measure your projector's performance yourself with the . . .

16mm "JIFFY" TEST FILM

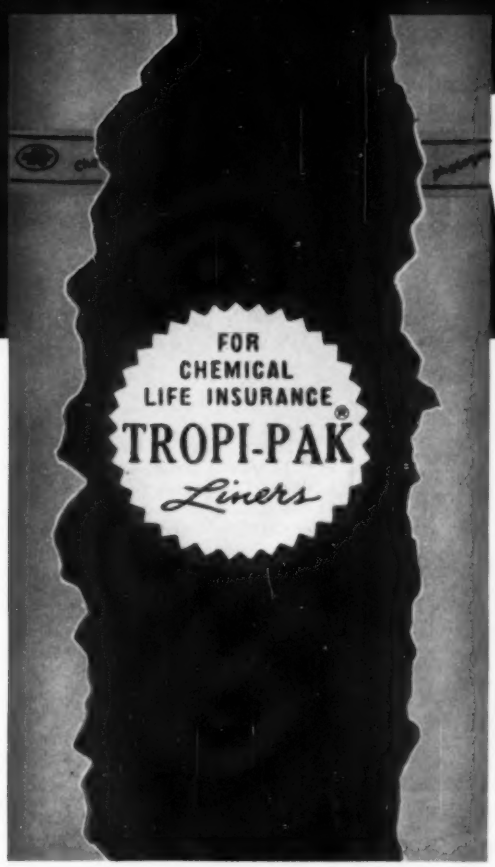
- Points up both projection and sound troubles
- Instruction booklet supplied with the film
- Test instruments are not required. Write . . .

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS
55 West 42nd Street, New York 36, New York

PROTECT YOUR PROCESSING WITH

RUSSELL'S TROPI-PAK® PROTECTED

A.S.A. QUALITY CHEMICALS



When you open a **RUSSELL** drum, you have chemicals which meet the PH4 Specifications of the American Standards Association. You will also discover something else... that all **RUSSELL** chemicals are protected by **TROPI-PAK** liners.

TROPI-PAK is an "Extra" that **RUSSELL** provides. It states that at **RUSSELL** there is pride of product concern... that all chemicals remain A.S.A. quality from start to finish.

That's why with **TROPI-PAK** protection you will never find Lumping, Caking, Hardened chemicals. **TROPI-PAK** prevents Airborne Contamination; keeps out Harmful Moisture; insures that **RUSSELL** chemicals are always Free Flowing; are "Factory Fresh" regardless of how long they remain on your shelf.

RUSSELL PH4 A.S.A. photographic chemicals with **TROPI-PAK** protection assures quality processing. If you want protected processing... then you'll want **RUSSELL'S TROPI-PAK** insured chemicals.

Write for free catalogue.

L. B. RUSSELL CHEMICALS

INCORPORATED

14-33 31st AVENUE • LONG ISLAND CITY 6, NEW YORK

In Canada: L. B. RUSSELL CHEMICALS (CANADA) LTD. • 27 Cumberland St., Toronto, Ontario

section reports

The Atlanta Section met on March 19th at WETV Studios in Atlanta. An audience of twenty-seven heard Bob Reed, Production Manager of WETV, discuss a "Survey of Educational TV and Aims of WETV," and Tom Cowan, WETV Chief Engineer, talk about "Equipment Used by WETV."

Educational TV started rather slowly six years ago. There is now, however, a rapid acceleration in the formation of new stations. Presently, there are 38 noncommercial, educational TV stations in the United States. These stations are supported in three different ways: by universities, Community Educational Foundations, and Boards of Education. WETV is one of the few stations supported by a Board of Education.

The educational TV stations are formed into a loose network. The National Educational TV Center in Ann Arbor, Mich., provides for and acts as a clearing house for films for all of the educational TV stations. This center received its initial support from the Ford Foundation.

Many experiments are now in progress to determine the effectiveness of teaching by means of TV. The results are not yet conclusive, but TV teaching promises to be very effective, in some ways more effective than conventional means.

WETV is licensed to the Atlanta Board of Education. It concerns itself primarily with classes on teaching. Live broadcasts are scheduled daily from 9:00 a.m. to 2:00 p.m., for classroom use. At night, there is a community educational service, based largely on film programs from the Educational TV Center at Ann Arbor.

Mr. Reed delivered a convincing and dynamic talk on educational television which prompted the liveliest question and answer period in the history of this Section. The audience was especially interested in Mr. Reed's talk because of the important role TV could play in this area if Georgia's public schools are closed over school integration.

Mr. Cowan described the equipment used by WETV and conducted the group on a tour of the studio after the meeting. An informal discussion period with refreshments followed the tour—Wesley R. Sandell, *Secretary-Treasurer*, Kodak Processing Laboratory, 4729 Miller Drive, Chamblee, Ga.

The Atlanta Section held a two-day seminar meeting on May 15 and 16 at the Georgia Center for Continuing Education, University of Georgia, Athens.

Following a dinner on the first day of the meeting, Gerard Appy, associate director of the Center, welcomed the group of 29 and discussed the history of the Center. The Georgia Center for Continuing Education attempts, he said, to extend the program of the University of Georgia to the greatest possible extent to all age groups through the media of mass communications. Mr. Appy discussed the problems encountered in establishing a television center at the Center. He pointed out that the station is not yet on the air due to remaining problems, primarily political, that he expects to be solved soon.

J. Aubrey Smith, a member of the staff of the University of Georgia Agricultural Extension Service and the Atlanta Section of SMPTE, showed a 16mm film produced by the Extension Service entitled *4-H and the Insect World*. This film was designed to instruct 4-H youths on insect control and to show others some of the work being done by the 4-H organization. The film included some very fine close-up shots of insects.

Ed Graham, Chief Engineer of the Center, concluded the evening by demonstrating the equipment used by the Center and conducting the Section members on a tour of the Center's facilities.

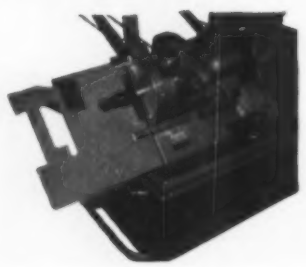
The second day of the meeting was devoted to the presentation of papers that were originally delivered at the 85th Convention in Miami Beach. Forty six members and guests attended this session.

The papers that were presented were:

(1) "New Horizons," by Paul Wittlig, CBS Television Network. Mr. Wittlig was unable to attend the meeting but he sent a 26-minute film which demonstrated the essential points of his paper.

OUR EXPERIENCE IS YOUR KEY TO
SERVICE & DEPENDABILITY

ANOTHER CAMART FIRST!
CAMART ADD-A-UNIT EXTENSION PLATES
For Moviola Series 20
(U. S. Pat. Pending)

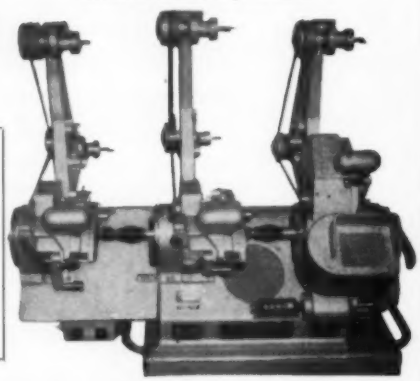


Now add a third sound head to your two head Moviola using this easy as A-B-C attachment:

- ADD-A-UNIT for your sound effects.
- ADD-A-UNIT for your musical background.
- ADD one or two extra to your two-head Moviola.
- ADD-A-UNIT installs units in a few minutes.
- ADD-A-UNIT requires no drilling or tapping.
- ADD those needed extras.

Add excitement to your films.

AND YOU CAN ADD FOURTH AND FIFTH SOUNDHEADS JUST AS EASILY! MAKE ANY COMBINATION OF 16mm AND 35mm OPTICAL-MAGNETIC SOUND HEADS.



CAMART ADD-A-UNIT EXTENSION PLATE is complete with extra belt guard, flange, flexible coupling assembly, separate volume controls, for each head, and amplifier attachments (for Moviola Series 20 machines). . .

$325.00 f.o.b. N. Y.

Separate soundheads or take-ups additional. Prices on request.

The original CAMART ADD-A-UNIT EXTENSION PLATE is available only at the Camera Mart, Inc. or their exclusive franchised dealers.

the CAMERA MART inc.
1845 BROADWAY (at 60th St.) NEW YORK 23 • PLaza 7-6977 • Cable Cameramart

Spotlight on

From the lowest whisper to the most piercing note, every sound is recorded with the utmost clarity on Gevaert S. T. 6. The high resolving power of the emulsion and the absence of "fill-in" guarantee sound recordings superlatively clear and well defined. This scientifically balanced emulsion practically eliminates all ground noise, and at the same time permits excellent recording quality, even in the highest frequencies.

Negative films
Duplicating films
Sound recording films
Positive films
Reversal films
Gevacolor films
Magnetic film

GEVAERT **Complete assortment of highest quality material**

GEVAERT PHOTO-PRODUCTEN N.V. MORTSEL (ANTWERP) BELGIUM

In the U. S.: The Gevaert Company of America, Inc., 321 West 54 Street, New York 19
In Canada: Photo Importing Agencies Ltd., 345 Adelaide Street West, Toronto 2B, Ontario

(2) "Technique of the Visual Squeeze," by Robert Bergmann, Transfilm, Inc. An interesting discussion of this paper followed Mr. Bergmann's presentation.

(3) "A High-Speed Color Negative Film," by Dr. Merle L. Dundon, Film Emulsion and Plate Manufacturing, Eastman Kodak Co., Rochester, N.Y. This paper was presented by Dr. W. T. Hanson of the Eastman Kodak Co. Research Labs.

(4) "Motion Pictures in the Electronic Age," by E. M. Stifle, Eastman Kodak Motion Picture Sales Division.

(5) "Professional Motion-Picture Training, Liberal Education and the Communication Arts Curriculum," by A. Nicholas Vardac, College of Communication Arts, Michigan State University, East Lansing, Mich. Bob Reed of Station WETV, Atlanta, presented the paper for Mr. Vardac.

(6) "Motion Picture Processing Equipment for Guided Missile Research," by John P. Delangre, Houston Fearless Corp., Los Angeles. B. H. Loden presented the paper for Mr. Delangre.

The seminar was considered of great value and interest, especially to those members who were unable to attend the National Convention in Miami. We hope that the experience of this meeting will serve as a guide in the preparation of our next seminar.—Wes Sandell, *Secretary-Treasurer*, Kodak Processing Lab., 4729 Miller Drive, Chamblee, Ga.

The Boston Section held a joint meeting with the Society of Photographic Engineers on May 25 at the AVCO Research and Advanced Development Division, Wilmington, Mass. Eighty-five members and guests heard Joseph A. Hull of AVCO's Instrumentation Research Laboratory discuss "Electronic and Photographic Problems Associated with Ultra High-Speed Kerr-Cell Photography."

The meeting opened with a report by Joe Rothberg on the Section's membership activity. Gary H. Mensur, AVCO Public Relations Assistant, welcomed the group to AVCO, and introduced Gilbert H. Haimsohn, AVCO Motion-Picture Laboratory, who discussed the activities of his section and showed a film on arc plasmas as an example of the type of work done by his division. His talk was followed by a tour of the AVCO Motion-Picture Laboratory.

Following the tour, Joseph A. Hull spoke on "Electronic and Photographic Problems Associated With Ultra High-Speed Kerr-Cell Photography." He gave an interesting demonstration in which he photographed a bullet in flight, using a Kerr-cell shutter and a Polaroid camera. An interesting discussion period followed his talk.

Coffee and doughnuts were supplied by Ray C. Tourangeau of the Ansco Film Corp. at the conclusion of the meeting.—Robert M. Fraser, *Secretary-Treasurer*, ITEK Corp., Boston Mass.

PEERLESS
25 Years of Service to FILM

Scratches on Film Irritate Audiences

Scratches are havens for dirt, and refract light improperly. On the screen, they mar the picture and may distract attention. If on the sound track, they produce offensive crackling.

Fortunately scratches can almost always be removed — without loss of light, density, color quality, or sharpness. *Write for brochure*

PEERLESS
FILM PROCESSING CORPORATION
165 WEST 46th STREET, NEW YORK 36, NEW YORK
959 SEWARD STREET, HOLLYWOOD 38, CALIF.

The Canadian Section had an audience of 102 in attendance at a symposium on May 23 at the Sheraton-Brock Hotel, Niagara Falls, Ontario. The symposium on "What Will Videotape Mean to You?" was attended by SMPTE members and guests from Montreal, Syracuse, Rochester, Buffalo, Cleveland and Detroit.

Jim Detler of the Ampex American Corp., first speaker at the meeting, discussed the principle of operation of the Videotape recorder including a description of its unique features and its recent modifications. He pointed out that at the time of his talk there were 18 Videotape installations in Canada.

Ray Brule, Minnesota Mining and Manufacturing Co. of Canada, spoke on "Video Recording Tape." He discussed the technical and other aspects of the special magnetic tapes necessary to the successful operation of video-tape machines.

Following Mr. Brule's presentation, Price Fish of the Columbia Broadcasting System, New York, talked about the use of video tape by CBS.

A cocktail party and dinner at the Sheraton-Brock followed the meeting.—Ron E. Ringler, *Secretary-Treasurer*, DuPont Co. of Canada Ltd., 85 Eglinton Ave., E., Toronto, Ont.

The Chicago Section enjoyed the hospitality of Cook Research Laboratories and Cinefonics, Inc., Divisions of Cook Electric Co., Morton Grove, Ill., for its April 23 meeting. There were 110 members and guests present.

In a program devoted entirely to a part of the research facilities and techniques employed by Cook Electric Co., members were given a comprehensive revue of some of the company's latest developments as well as a description and demonstration of the important part films play in this work.

Robert F. Bosshart, Technical Head of Systems Development Section, Cook Research Labs., described "Some Recent

in the East it's . . .

MOVIELAB

for

COLOR

EASTMAN COLOR

- DEVELOPING 35MM (5248) COLOR NEGATIVE
- DEVELOPING 35MM (5253) AND 16MM (7253) INTERMEDIATES
- 35MM ADDITIVE COLOR PRINTING
- 16MM CONTACT AND REDUCTION ADDITIVE COLOR PRINTING
- INTERNEGATIVES 16MM (7270) FROM 16MM KODACHROMES
- BLOW-UPS FROM 16MM KODACHROME TO 35MM COLOR
- KODACHROME SCENE TO SCENE COLOR BALANCED PRINTING
- 35MM COLOR FILM STRIP PRINTING

MOVIELAB

COLOR CORPORATION

Write for Color Methods Brochure

MOVIELAB BUILDING · 619 W. 54th ST. NEW YORK 19, N. Y. · JUDSON 6-0360

Developments in Acoustic and Optical Instruments and Data Handling Equipment." Among the units described was an automatic weather-data recorder which tape records an electric signal representing certain elements of weather data such as temperature, wind velocity, humidity, transmissivity and barometric pressure, etc. This information can be gathered at certain preset intervals, and when plotted, proves helpful in making more accurate long-range weather forecasts.

Mr. Bosshart also described a method for measuring wind velocity with a sonic anemometer. With this technique, a signal is generated, picked up, and the time interval recorded. Analysis of the time interval makes it possible to measure wind velocity. These techniques were demonstrated and the equipment used was available for inspection following the presentation of the formal paper.

Harold Kopel, Cinefonics, Inc., carried the second portion of the program with his discussion of "Motion Pictures as a Research and Development Tool." Mr. Kopel described several engineering programs in which film was used as an engineering record for subsequent detailed analysis. Included were such projects as a time-lapse study of Chicago's Midway Airport to establish an accurate portrayal of the ground-traffic pattern of the nation's busiest commercial airfield. Also using the time-lapse technique, studies were made of air-traffic patterns by photographic radar screens. Other engineering film studies included high-speed filming of parachute tests to determine failure and flutter in supply 'chutes. Accurate studies were possible in situations under which first-hand inspection was either impossible or too hazardous.

Coffee was served during the evening through the courtesy of Crescent Film Labs., Inc., Chicago. Prior to the meeting, approximately 25 members and guests joined the speakers for dinner at the Morton House Restaurant in Morton Grove.

We are deeply indebted to George Meyers, Cook Electric Co., newly elected member of the Chicago Section Board of Managers and Allen Hilliard, Chicago Section Program Chairman, for arranging and conducting this fine program.—William H. Smith, *Secretary-Treasurer*, Lakeside Lab., Box 2408, Gary 5, Ind.

The Dallas-Fort Worth Section met on March 26 at Chance Vought Aircraft Corp., to hear a discussion of Photography in the Aircraft Industry by George Franko. Following Mr. Franko's talk, he showed a thirty-minute film of the high-speed photography of seat ejection tests, flight capsule separation, high-speed sled tests and simulated speed runs. A tour of the Chance plant consumed a major portion of the evening.—Philip W. Wygant, *Secretary-Treasurer*, 6021 Plants Ave., Dallas 12, Texas.

The New York Section held its last meeting of the season prior to the summer period on May 20 at the Carl Fischer Concert Hall in New York City, with an audience of 65. The program was concerned with A Mobile Color Television Unit operated by Smith, Kline & French Laboratories, Inc., and was presented by three engineers from this unit.

Donald J. Hart, Chief of Electronics Development of the Medical TV Unit, spoke on the technical aspects of the mobile unit. Louis W. Crist, Supervisor of Color Television Production at Smith, Kline & French, covered the administrative and production phases of the unit and A. R. Stanley, Consultant to Smith, Kline & French Laboratories in England, spoke on the operation of the unit in England and some of his experiences in color television in England.

Starting out in 1949 with a field sequential color television system and one color television camera, Smith, Kline & French Laboratories have converted to the compatible color-TV system and now have three color television cameras and a complete color mobile television unit. This unit is mounted in a bus which has traveled to all the major cities in the United States and several foreign countries presenting closed-circuit color television programs of medical interest.

The modifications and miniaturization of color television equipment necessary for a mobile unit were of special interest to the audience. The development of a mirror attachment to the camera used in the operating room was one of the unique features of this unit.

In order to present a picture to a large audience, this unit has a Norelco (Philips) large-screen compatible color television projector. This three-tube color television projector system uses a 9 × 12 screen and has a brightness of 5.5 ft-L. A 16mm color kinescope recording was shown at the meeting to demonstrate the quality of their TV image and also their ability to record this image on film.

A discussion period followed Mr. Stanley's comparison of color-TV in England and in the United States.—Edward M. Warnecke, *Secretary-Treasurer*, Eastman Kodak Co., 342 Madison Ave., New York, N.Y.

The Rochester Section met on April 23 at the Dryden Theatre, George Eastman House, with an attendance of forty-two.

James Card spoke to the group about "Film Preservation at Eastman House." His informative talk was on the problems associated with obtaining old negatives and restoring them to condition for final prints to be used in the collection of the George Eastman House. Several examples of films of different eras were projected. During the projection, Mr. Card gave a running commentary of techniques and problems of the particular era. Some of the very early attempts in color, including handpainting of individual frames, were demonstrated. As an example of up-to-date techniques, several scenes from recent Japanese productions on current color material were shown.—R. E. Connor, *Secretary-Treasurer*, 35 Chatham Park, Rochester 18, N.Y.

Send Your Film To The Complete 16MM Service Laboratory

Unsurpassed for . . .

SPEED — QUALITY — Personalized SERVICE

MOTION PICTURE LABORATORIES, INC.

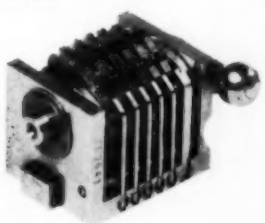
781 S. Main Street Memphis 6, Tenn. Phone WHitehall 8-0456

MPL

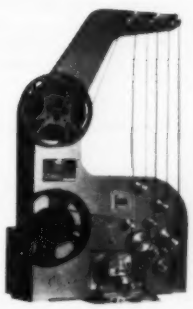
The Master Craftsmanship Your Film Deserves

EDGE NUMBER ANY MOTION PICTURE FILM WIDTH

- Machine can edge number rolls up to 3000'.
- Friction devices control the payout reel. A torque motor allows the film to be taken up evenly and smoothly. An adjustment knob for the torque motor rheostat permits quick adjustment to take up 1000, 2000, and 3000 foot reels.
- The impression roller is free wheeling and self adjusts itself to give a most legible number without the danger of embossing.
- A simplified inking system with an eccentric center roller in the ink well provides quick alignment for the applicator sponge rubber roller. A doctor knife in the inkwell removes all surplus ink from the inking rollers.
- There is a simple adjustment for dispensing the amount of ink required. The unit has a small brush wheel to clean the numbering element after the number is applied.
- A micro switch cuts the power when a roll of film is completed.
- A Veeder Root counter checks the film footage.
- A keeper holds the film in place for sync mark and spot coding.
- The handle in front permits the operator to manually turn the numbering block to the desired position for a number change.
- Running speed is between 80 to 110 feet per minute.



- ENM-16 numbers 16MM film every 40 frames. An adjustment bar permits edge numbering the film in any area (16MM only).
- ENM-16-M numbers 16MM film every 16 frames to match 35MM. Numbering can be done in any position on the film.
- ENM-35 numbers 35MM film every 16 frames. A combination 17½-35MM machine is available at a slightly higher cost.
- ENM-70 numbers 70MM film every 16 frames. (Equipped with an 80 tooth sprocket with five perforations per frame.)



ENM-16
$2675.

ENM-16-M
$2995.

ENM-35
$2500.

ENM-70
$3250.

NUMBERING BLOCK

- The numbering block generally consists of two letter wheels or one number and one letter wheel manually operated and four number wheels which move automatically and number from 0001 to 9999. All numbers can be reset by hand to begin at any desired number.
- ENB-35 ($400)... Numbering block for 35MM indirect reading. Two letter wheel and four numbers.
- ENB-16 ($400)... Numbering block for 16MM direct reading. One letter and four numbers wheel or two letters and four number wheel.

MAIN OFFICE: 956 SEWARD, HOLLYWOOD, CALIFORNIA, HO 2-3284

HF HOLLYWOOD FILM COMPANY • reels • cans • shipping cases

BRANCH: 524 WEST 43RD ST., NEW YORK, NEW YORK, LO 3-1546

Obituary

William J. Morlock

On May 24, 1959, after a long illness, William J. Morlock died at the age of 50. Until recently, he had been General Manager of General Electric Co.'s Technical Products Dept., and at the time of his death he was acting as consultant to the General Manager of the Industrial Electronics Div. He joined General Electric Co. in 1947 after 17 years with Radio Corp. of America. During World War II he was a committee member of the Office of Scientific Research and Development. For a number of years he was engaged in development and design of interior communication sound equipment used by the U.S. Navy and other government agencies. A member of the Society since 1947, he served on The Eastern Membership Committee 1955–1956. He was a Fellow of the IRE and was active in the Electronic Industries Association.

current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 40, Mar. 1959

TV News—Growing Market for Free Lance Cinematographers (p. 169) *F. Woodress*

Animated Film Techniques, Part VIII (p. 170)

The Mitchell—Hollywood's Favorite Studio Camera (p. 174) *C. Loring*

Operation "Restoration" (p. 176) *A. Rowan*

Do-It-Yourself Sound Recording, Part V (p. 182) *A. Jacobs*

vol. 40, Apr. 1959

Licking Contrast Problems with ND Filters (p. 228) *J. V. Mascelli*

Automatic Exposure Control for Any Camera (p.234)

Can Ektachrome be Intercut with Kodachrome? (p. 236)

vol. 40, May 1959

The Mitchell Camera Pt. II (p. 294) *C. Loring*

800-Ft Magazine for Data Cameras (p. 295)

Choosing and Using Lenses (p. 296)

Animated Film Techniques, Pt. IX (p. 298) *V. Palen*

Low-budget Optical Printer (p. 300) *C. V. Harrington*

British Kinematography vol. 34, Jan. 1959

16mm "Ektachrome" Commercial Film (p. 4) *B. J. Davies*

vol. 34, Feb. 1959

Censoring Films (p. 44) *J. Trevelyan*

Planetarium Projection (p. 48) *R. Edds*

vol. 34, Mar. 1959

The Modern Concept of Picture Quality

International Projectionist vol 34, Feb. 1959

Projection Screens for 16-mm Film Showings (p. 5) *R. A. Mitchell*

vol. 34, Mar. 1959

Cinemascope: Keynote of Modern Projection (p. 5) *R. A. Mitchell*

The Carbon Arc for 16-mm Film Projection (p. 8) *R. B. Dull*

vol. 34, Apr. 1959

The Videotape Recorder (p. 5) *G. B. Goodall*

Intermittent Movements for 16-mm Projectors (p. 10) *R. A. Mitchell*

Viewing the Projector as an Integral Optical-Mechanical System (p. 12) *H. E. Rosenberger*

The Geneva Intermittent Movement: Its Construction and Action (p. 15) *A. C. Schroeder*

Journal Audio Engineering Society vol. 6, July 1958

Mylar Polyester Film and Acetate as Base Materials for Magnetic Recording Tape (p. 187) *D. L. Ormond*

Kino-Technik vol. 13, Feb. 1959

Filmverarbeitung in Amerikanischen Kopieranstalten (p. 26) *K. Würstlin*

Vermeidung elektrostatischer Entladungen bei Filmen (p. 30)

Filmtechnische Einrichtungen beim NWRV in Hamburg (p. F9) *U. Stepputat*

Die Wirkungsweise der Photozelle in Lichttonanlagen (p. 38) *G. E. Wegner*

vol. 13, Mar. 1959

Schmalfilm-Geräte für alle Amateur-Aufgaben (p. 46)

Die Xenon-Kurzbogenlampe in der Kinoprojektion (p. 55)

Die Ausrüstung eines modernen Fernseh-Kleinst-Studios (p.F17) *P. Süther*

Kino-Technik vol. 13, Apr. 1959

Anwendung des 16-mm-Films in der industriellen Verfahrenstechnik (p. 68) *W. Kraus*

Zeitraffer-Filmaufnahmen an einer Schleifscheibe (p. 71) *H. Opitz and B. Rupprecht*

Wissenschaftliche Kinematographie und menschliches Verhalten (p. 75) *P. Spindler*

Die Kinematographie in der experimentellen Medizin (p. 78) *E. Dunker*

Automation bei der Entwicklung von Schmalfilmen (p. 79) *H. Lechner*

Selbst von ältesten verschrammten Negativen gute Kopien (p. 83)

Beseitigung der Hörbarkeit von Magnettonfilm-Klebestellen (p. F25) *F. Krones*

La Technique Cinématographique vol. 28, No. 196, Mar. 1959

Une solution française de caméra vidéo-optique (p. 66)

TEL-Animastand® with ELECTRONIC ZOOM
Animation & Special Effects Camera Stand

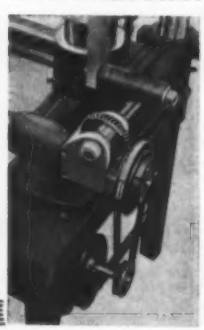
Specially Designed for Motion Picture Producers, Animators, Special Effects Laboratories, TV Stations Advertising Agencies, Art Depts., Etc.

Installations Throughout the World! Outperforms any animation stand in the low priced field. Compare the many outstanding features... embodies features of the photo enlarger, movie camera, micrometer and railroad roundhouse. Optical effects such as pans, angles, zooms, and quick closeups are accomplished by simply raising or lowering the camera—every variation for trick photography may now be easily produced with the S. O. S. TEL-Animastand.

A camera fitted to a movable, counterbalanced vertical carriage photographs the art work. Will accept even the heaviest 16mm or 35mm camera (Acme with stop motion motor illustrated).

All basic movements associated with high-priced stands are incorporated. Accuracy is assured through precise registration of art work. Rugged construction maintains stability.

Write for illustrated brochure



BASIC UNIT ONLY $2995

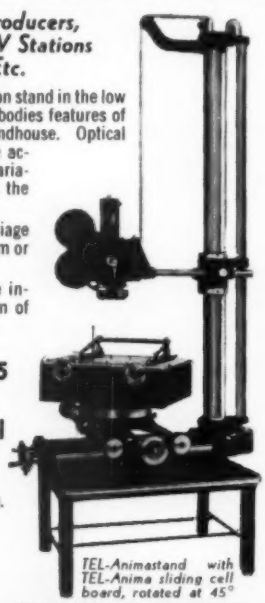
New Electronic Zoom Control

Features:

- Adjustable Dynamic Braking.
- Constant Motor Torque at any speed.
- Instant Response at any position.
- Infinite Variable Speeds.

Only $750

® Reg. Trademark



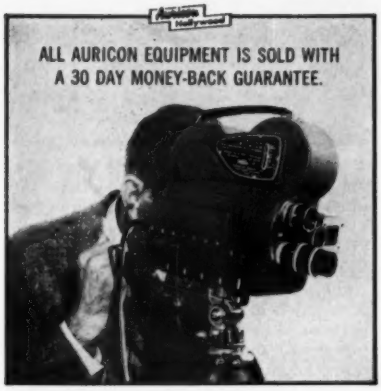
TEL-Animastand with TEL-Anima sliding cell board, rotated at 45°

S.O.S. CINEMA SUPPLY CORP.

Dept. T, 602 WEST 52nd ST., NEW YORK 19, N. Y. Phone: PL 7-0440
Western Branch: 6331 Hollywood Blvd., Hollywood 28, Calif. Phone: HO 7-2124

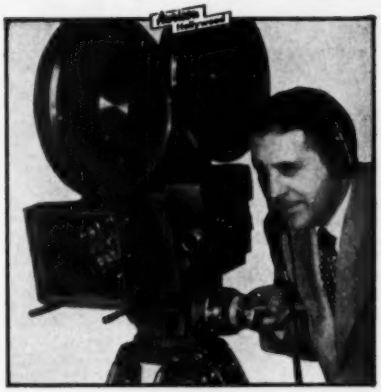
FOR R&D PROGRESS REPORTS and COMPANY PRESENTATION FILMS, Choose

AURICON 16mm Cameras for Professional Results!



"CINE-VOICE II" 16 mm Optical Sound-On-Film Camera. ★ 100 ft. film capacity for 2¾ minutes of recording; 6-Volt DC Convertor or 115-Volt AC operation. ★ $795.00 (and up).

"AURICON PRO-600" 16mm Optical Sound-On-Film Camera. ★ 600 ft. film capacity for 16½ minutes of recording. ★ $1871.00 (and up) with 30 day money-back guarantee.



"SUPER 1200" 16 mm Optical Sound-On-Film Camera. ★ 1200 ft. film capacity for 33 minutes of recording. ★ $5667.00 (and up) complete for "High-Fidelity" Talking Pictures.

TRIPOD—Models FT-10 and FT-10S12... Pan-Tilt Head Professional Tripod for velvet-smooth action. Perfectly counter-balanced to prevent Camera "dumping." ★$406.25 and up.

PORTABLE POWER SUPPLY UNIT—Model PS-21..Silent in operation, furnishes 115-Volt AC power to drive "Single System" or "Double System" Auricon Equipment from 12 Volt Storage Battery, for remote "location" filming. ★$269.50

FILMAGNETIC—Finger points to Magnetic pre-stripe on unexposed film for recording lip-synchronized magnetic sound with your picture. Can be used with all Auricon Cameras. ★ $870.00 (and up)

Write for your free copy of this 74-page Auricon Catalog

AURICON Cameras are superb photographic instruments for your FILMED REPORTS...

The new technique of **filming Progress Reports**, as covered by the Air Force "Table 210 Requirement," for example, has revolutionized reporting on R & D Projects. The work of many months can be telescoped into a 20- or 30-minute filmed documentary for the benefit of key executives and military personnel who have limited time, but a great need to gather an over-all impression as quickly as possible.

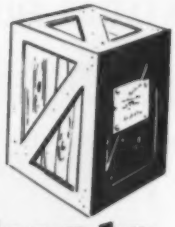
Major aircraft or missile manufacturers are using Auricon Professional 16mm Cameras for filming R & D Progress Reports in compliance with contractual obligations to the Armed Services and Government Agencies, under requirements such as Air Force "Table 210."

Presentation Films of R & D Engineering Extracts, Scientific Developments, Training Films, Company Facilities and Scientist and Engineer Recruitment Films are being produced with quality and dependability in full color or B & W, using Auricon Professional Cameras. Auricon Cameras have **advanced features** which set them apart as superb photographic instruments for precision film-making!

AURICON
A PRODUCT OF
BERNDT-BACH, INC.
6946 Romaine Street, Hollywood 38, California
HOllywood 2-0931

GUARANTEE
All Auricon Equipment is sold with a 30-day Money-Back Guarantee. You must be satisfied!

MANUFACTURERS OF ELECTRONIC-OPTICAL RECORDING EQUIPMENT SINCE 1931



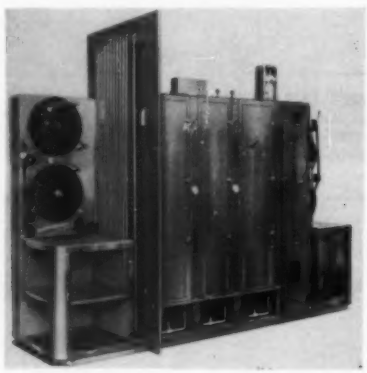
new products

(and developments)

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

The Cine Speed Instant Film Processor which processes motion pictures instantaneously and simultaneously during the photographing, is a development of J. A. Maurer Co. of Long Island City for Cine Speed Inc., Roosevelt Raceway, Westbury, L.I., N.Y., which sponsored the project for the past ten years and has world-wide distribution rights for the processor. The object of the design project was to find a process whereby film, feeding through the sprocket, could be developed simultaneously as the photographing was going on. This process is intended to serve the dual purpose of eliminating laboratory costs and of saving valuable time in spot news photography. Presently available for 16mm, further adjustments are being made to provide a 16mm and 35mm processor. The processor can be purchased at an approximate price of $2250.

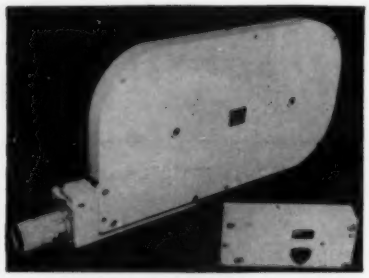
A new 35mm Eastman Color Negative Film, Type 5250, has been introduced by Eastman Kodak Co. The new film has a similar structure but is said to have twice the speed of Type 5248, which it was designed to replace. The new film has exposure indexes of 50 tungsten and 32 daylight, with a conventional conversion filter. The color rendition is substantially the same as with present materials with the exception of blues which exhibit a favorable decrease in brightness. Although it is primarily designed for 35mm, other widths to be available are 65mm and 70mm. Standard reel lengths are 100, 400, 1000, and 2000 ft. The high speed of the new film will permit motion pictures to be made in color under lower light conditions than before possible, with lower heat-illumination levels on motion-picture sets, and it is expected to help solve the numerous lighting problems encountered overseas in such underpowered areas as the Far East as well as in the North where daylight hours are limited. The new film was introduced at the Society's Convention in Miami Beach, May 3–8, in a paper by Merle L. Dundon, "A High-Speed Color Negative Film."



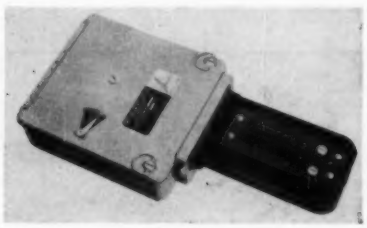
The Rapid Spray Film Processor introduced by Houston Fearless Corp., 11827 W. Olympic Blvd., Los Angeles 64, uses high-impingement spray application of the developing solution, fix and wash to achieve fast processing time of 150 ft/min for 16mm or 35mm black-and-white positive film or 100 ft/min for negative film. Complete processing time for positive film is reported as short as five minutes from dry to dry. Improved spray bars are incorporated to assure uniform results. Impingement drying is also employed. Other features include a direct film drive incorporating separate gear boxes for each compartment, automatic film tension control, accurate temperature control, a new type of air squeegees and electric tachometer. Price of a typical installation is estimated at $30,000.00.

A new data analyzer, the Red Lake 35mm Stop-Motion Projector, is marketed by Red Lake Laboratories, P.O. Box 271, Mahopac, N.Y. The projector, designated model RL-35PS, features variable speed of 8 to 24 frames/sec forward and reverse, also single frame; easily reset frame counter; 1000-ft capacity reel arms; hand operation if desired; power supply 110-v, 60-cycle, 15 amp-line sufficient; 1000-w projection lamp. Standard projection lens is Wollensak 2¾ in. focal length *f*/1.9 — others available. The price is $149.00, f.o.b. Chicago.

The Photo-Sonics 16mm-lb high-speed rotating prism camera is a product of Traid Corp., 17136 Ventura Blvd., Encino, Calif. A 1200-ft film magazine is included to permit operation for a full 50 seconds



at a rate of 1000 pictures/sec. Featuring stop-start capability at any point in the film roll, the camera is especially suited to rocket engine test work. Other features of the camera include a disk shutter located behind the prism, and turning in synchronism with the prism. This combination is designed to mask off the less desirable portions of the image transmitted through the prism, and is said to result in high-speed motion pictures that closely approach in resolution those obtained from precision intermittent-type cameras.



A 200-ft capacity M-1 16mm film magazine has been added to the line of specialized photographic equipment produced by Flight Research Inc., P.O. Box 1-F, Richmond 1, Va. Designed to increase the versatility of the Flight Research 16mm Model III and III-B Multidata data recording cameras, the magazine can accommodate film lengths of 50, 100, or 200 ft. The magazine uses the same film transport as the 800-ft M-3 magazine. A drive member is supplied with the M-1 to make the M-3 and M-1 interchangeable.

High-resolution TV equipment operating on a Navy standard of 875 scanning lines has been developed for the Navy Bureau of Ships by General Precision Laboratory Inc., Pleasantville, N.Y. The equipment is designed to transmit and view information heretofore considered impossible or impractical. It is particularly applicable to the fast transmission of large quantities of printed matter, alpha-numeric or symbolic information. The TV equipment has a bandwidth of 20 mc and provides a horizontal picture resolution of 1000 lines. Of rugged mechanical design, it uses JAN components for maximum reliability. The equipment is also reported to have such features as: 630-line vertical resolution; system geometry better than ±2%; aspect ratio variable between limits of 1 : 1 and 3 : 4 (height to width); sync generator to combine stability of binary counters and accuracy of delay line control of line rate pulse timings and widths; optimum corner resolution achieved by use of specially designed deflection components and focus modulation in both

ARRIFLEX® promotes your business...

with ads directed to those who need motion picture films!

Throughout 1959, Arriflex advertising will be seen regularly by the nation's top management personnel. Fortune, Business Week, Management Methods, and Scientific American magazines will carry the message to a combined circulation of nearly 1,000,000 readers.

A milestone in ARRIFLEX advertising...this campaign is designed to perform a pre-eminent service to cinematography as a whole, and the professional producer in particular. A list of professional producers, who use ARRIFLEX to film quality motion pictures, accompanies the literature requested by potential motion picture users.

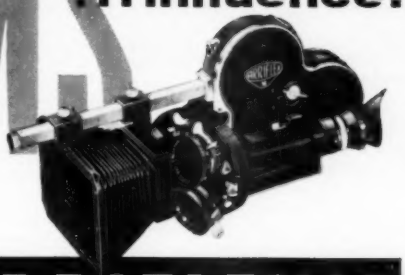
In this manner we say "Thanks" to you, the professional producers who have overwhelmingly accepted ARRIFLEX, and helped to make it "the choice of professionals all over the world."

MOTION PICTURE

FILMS

are the best means to

sell...teach ...influence!



Just a few of the hundreds of satisfied Arriflex users

Avco Mfg. Corp.
Boeing Airplane Company
Bendix Aviation
Chase Manhattan Bank
Chrysler Corporation
Cook Electrical Research
Dow Corning Corporation
E. I. DuPont de Nemours
General Electric Co.
General Motors
Grumman Aircraft Engr. Corp.
Hughes Tool Co.
International Business Machines
International Harvester Company
Kimberly Clark Corporation
Kraft Foods Co.
Lockheed Aircraft Corp.
North American Aviation
Pan American Airways
Remington Rand
Rocketdyne, Inc.
Time, Inc.
U.S. Bureau of Standards
U.S. Army, Navy, Air Force
Western Electric Co.

ARRIFLEX® 16

Find out why the motion picture departments of the nation's leading companies and professional film producers prefer the ARRIFLEX® 16...the world's most versatile, **money saving** production camera.

FREE: Mail this coupon for literature and list of professional industrial motion picture producers, to:

KLING PHOTO CORPORATION
257F Fourth Ave., New York 10, N. Y.

name .....

company .....

address .....

city ..... zone ..... state .....

MOTION PICTURE

FILMS

are the best means to

sell...teach ...influence!

Find out why the motion picture departments of the nation's leading companies and professional film producers prefer the **ARRIFLEX® 16**...the world's most versatile, **money saving** production camera.

Write for **FREE** literature and list of professional industrial motion picture producers.

ARRIFLEX division of
KLING PHOTO CORPORATION
257 Fourth Ave., New York 10, N. Y.

name _____

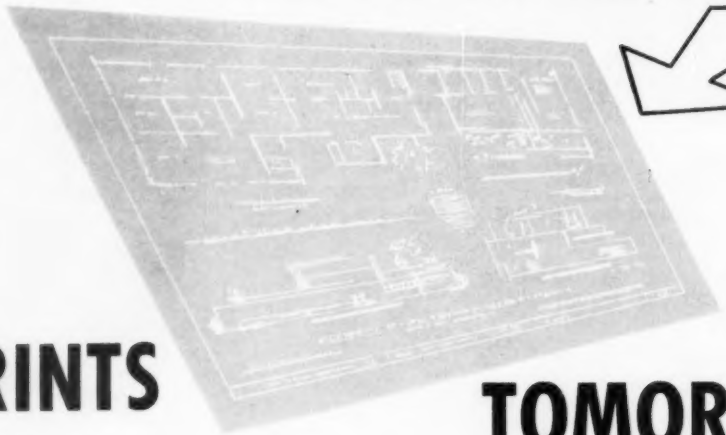
address _____

city _____ zone ___ state _____

ARRIFLEX® division of **KLING PHOTO CORPORATION** 257 Fourth Ave., New York 10, N. Y.

DU ART

TRI ART



BLUEPRINTS TOMORROW

△ THE ULTIMATE IN SCREENING FACILITIES

New 60 seat theater and separate conference room with 16mm projection.

△ FIRST JET SPRAY COLOR PROCESSOR

△ TWO NEW FLOORS OF CUTTING ROOMS AND OFFICES

ALL AVAILABLE IN EARLY SUMMER!

TRI ART COLOR CORPORATION

(a subsidiary of Du Art Film Labs., Inc.)

245 West 55th St., New York 19, N. Y. • PLaza 7-4580

IN CANADA: ASSOCIATED SCREEN INDUSTRIES, Ltd. • 2000 Northcliff Avenue, Montreal, Canada

cameras and monitors; power supply outputs regulated to minimize picture-quality deterioration with line voltage variations of ±10% from nominal 117-v; regulated high voltage supplies in monitors; field rate 60-cycle, frame rate 30-cycle (interlaced 2 : 1); variable aperture correction provides up to 10-db boost at 20 mc.

Color television playbacks with Ampex Videotape Recorders will be a feature of the Moscow Fair. The recorder was selected by the Department of Commerce as representative of American technology. Families attending the Fair can be "shot" by a TV camera and then watch an instantaneous playback of themselves. Part of the daily schedule of events at the Fair will be a playback of color tapes pre-recorded in the United States.

First production unit of the RCA television tape recorder has been installed at Station WBTV, Charlotte, N.C., where a pre-production unit had previously been installed. Six pre-production units are being used by National Broadcasting Co., New York, and the NBC Tape Center, Burbank, Calif. The new tape recorder was introduced at the Convention of the National Association of Broadcasters in Chicago last March. The new recorder has been designed for the broadcaster to start monochrome programming with five "stand-up" racks of equipment, with provision for color by the addition of a sixth rack of color gear.

Technicolor's TV bandwidth reduction system is the subject of a recent agreement between Technicolor Corp. and Marquardt Corp. to facilitate application of the system to military requirements. The result of five year's work, the Technicolor system presently reduces by four times the bandwidth required for TV signal transmission. This reduction is accomplished by translating the signal into a simplified form roughly similar to the sequence of dots and dashes of the Morse code and unscrambling the code on the receiving end. The new system is expected also to be applicable to transoceanic television. The present agreement entered into specifically for military purposes associates the resources of Technicolor in the field of photographic and electronic image processing with those of Marquardt in the field of electronics and advanced military systems. A paper by W. F. Schreiber, C. F. Knapp and N. D. Kay, "Synthetic Highs — An Experimental TV Bandwidth Reduction System," presented on October 23, 1958, at the Society's Convention at Detroit, is planned for early publication in the *Journal*. The paper describes the system in detail.

The Eidophor Projector (*Journal*, Feb. 1959, p. 104) is now owned by a newly formed company, Eidophor Inc., a subsidiary of CIBA, a world-wide drug, dye and plastics concern. Announcement of the new ownership was made in New York, May 27, by means of a pre-filmed speech by Roderic L. O'Connor, President of the new company. The speech was projected on a 17 by 13-ft screen. Patent rights to the projector which operates on what is called a "control layer system" are owned by Ciba. In the "control layer" process, electrical impulses from the camera control an electron beam which bombards, and thus modifies, the surface of a film of oil on a concave mirror. Light passing through the resulting "wrinkles" in the oil film is projected through a special grating onto the screen. The principles and earlier equipment for the system were described in two technical articles in the April 1953 *Journal*, pp. 337–356, and initially in the *Journal* for April 1950, pp. 393–406.

The new company is reported to have ordered 40 black-and-white projectors and related equipment. It now owns two color projectors and a mobile unit for the production of color TV. Initial investment is about $1 million. The new company has also entered into a contract with Teletalent, Inc., producers of TV programs. The New York firm will produce Eidophor Inc.'s programs in medical, scientific and educational fields.

A new CECO Blimp designed exclusively for the Maurer Camera has been announced by Camera Equipment Co., Inc., 315 W. 43 St., New York 36. The new model features an external viewfinder. It is streamlined in styling and has a cam system for follow-focus parallax. Lenses from 15mm focal length can be used. It normally takes a 400-ft magazine. An additional hood for a 1200-ft magazine is available.

Optical-electronic techniques now being studied at RCA's David Sarnoff Research Center and other laboratories are expected to lead to high-speed data-handling systems that "read" print or pictures in the manner of the human eye, and process information in the form of coded light signals. The new methods are based upon the use of light-sensitive and light-emitting devices linked in networks to perform the coding, switching and information storage functions basic to electronic computing and data-processing. The studies were described by Egon E. Loebner, of RCA Laboratories, at a meeting of the Electrochemical Society in Philadelphia, May 6.

Dr. Loebner said that the systems might be constructed with various arrangements of image-processing panels comprised of photoconductive units which permit passage of current when they are exposed to light, and electroluminescent elements which emit light upon direct application of a

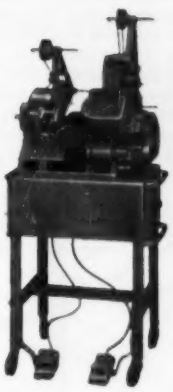
FIRST IN EDITING EQUIPMENT

SYNCHRONIZERS

REWINDERS

SOUND READERS

PICTURE AND SOUND EDITORS

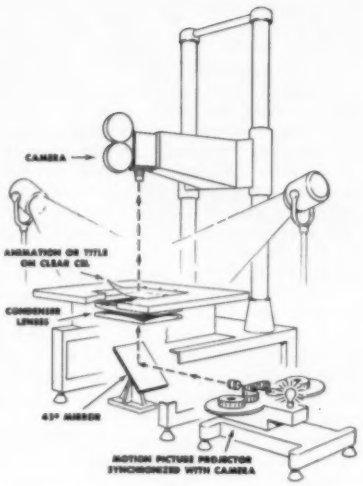


NOW A "CRAB" DOLLY

MOVIOLA
MANUFACTURING CO.
1451 GORDON ST.
HOLLYWOOD CALIF.

current. Both types of units are extremely small and consume little power, thus permitting use of many such elements in compact and economical systems capable of carrying on a variety of complex logic and switching operations simultaneously.

In operation, the flow of information would be controlled by the direction of light along optically selected directions to influence the flow of current to the electroluminescent units. In successive stages, the electroluminescent cells would themselves be the sources of light controlling further photoconductor cells and their associated electroluminescent units, creating a versatile network. The photoconductors would include a number of types with a variety of color responses. Different colors of light would then achieve various functions within the system.



An aerial image unit, designed by John Oxberry for use with animation stands has been announced by Animation Equipment Corp., 38 Hudson St., New Rochelle, N.Y. The unit, electrically interlocked with the camera, consists of a projector head, lens mount, stop-motion motor, precision-ground flat-surface mirror, a large condenser lens system, and all necessary controls. Film capacity is provided by four 400-ft chambers, two for feed and two for take-up, driven by electric torque motors. Fixed-pin shuttle movement has spring-loaded pressure plate that accommodated two films. Iris of the $f/2.8$ objective lens allows varying exposure on the projected film. Lamp wattage can be adjusted from 100 to 750. Three filter slots are provided.

The unit's stop-motion motor runs continuously forward or reverse and may be operated independently or in step with the camera's stop-motion motor. With the aid of this unit the camera can photograph a top-lighted cel and an underneath projected image simultaneously. A title may be superimposed over a live background or a small product may be animated over a live action scene with a single exposure or one-pass method. In using the aerial image unit with an animation stand, the ground glass in the table top is replaced with a clear glass. The light source of the unit projects through achromatic condensers, diffusing ground glass, color correcting filter (when required), to the black-and-white or color fine-grain film in the shuttle. An objective lens projects the film from the shuttle to form a $10\frac{1}{2}$-in. aerial image at the top surface of the field lens condensers. The objective lens of the animation camera picks up the aerial image and records it on raw stock. The aerial image at the table top cannot be seen with the naked eye, but may be viewed through the ground glass of the rack-over camera, or may be viewed on a piece of tracing paper or ground glass placed on the table top. The aerial image is focused at the table surface and is picked up at the camera lens at a specific height.

The camera must be in a precise predetermined position to pick up the aerial image. The compound table is held stationary to assure alignment of the optical system.

A 16mm camera with a self-contained magnetic sound system has been announced by Fairchild Camera and Instrument Corp., Robbins Lane, Syosset, L.I., N.Y., which has acquired exclusive marketing rights under an agreement with the Magnetic Sound Camera Corp., Chicago. Known as the Cinephonic, the camera is designed for maximum portability and, with its 100-ft magazine is easily handheld. The miniature, transistorized magnetic sound recorder is built into the unit. It records on conventional magnetic-striped film. Sound inputs allow the photographer to record the subject and background while simultaneously adding his own narration, or additional sound through a mixer input. A volume-unit meter is built into the sight to allow simultaneous observation of both scene and sound. The camera is equipped with earphones, magazine, cables and microphones. Price range is $1995 to $2250, depending on magazines, accessories, etc.

Early development of the system was presented to the Society at its 1956 Spring Convention in New York by Lowell A.

LIMIT AUDIO BAND WIDTHS...IMPROVE FIDELITY WITH THE ULTIMATE IN RECORDING FILTERS, THE StudioSound S-305...

A variable band pass filter that meets all requirements for restricting the frequency range in disc recording and similar applications. Generally used in dubbing and re-recording. Close spacing of cut-off frequencies at each end of the spectrum permits limitless choice of settings for optimum range.

Furnished on complete panel with separate in and out keys for each section. In and out jacks normaled to terminal strip in rear of assembly.

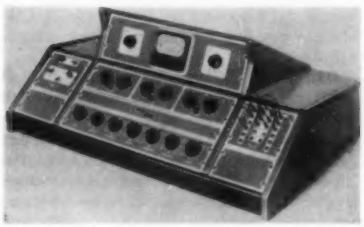
CONTROLS: Low frequency—15 positions; "off" and cut-off frequencies from 30 to 200 cps. High frequency—15 positions; cut-off frequencies 2 to 15 kc and "off." "Off" positions provide flat response. Two key switches permit independent insertion of either filter in and out of the line.

For further information on this and other quality StudioSound components such as Filters, Pads, Networks, Etc. please inquire in person or write to:

STUDIO SUPPLY CO.

711 So. Victory Blvd. Burbank, California Box FW-5-59

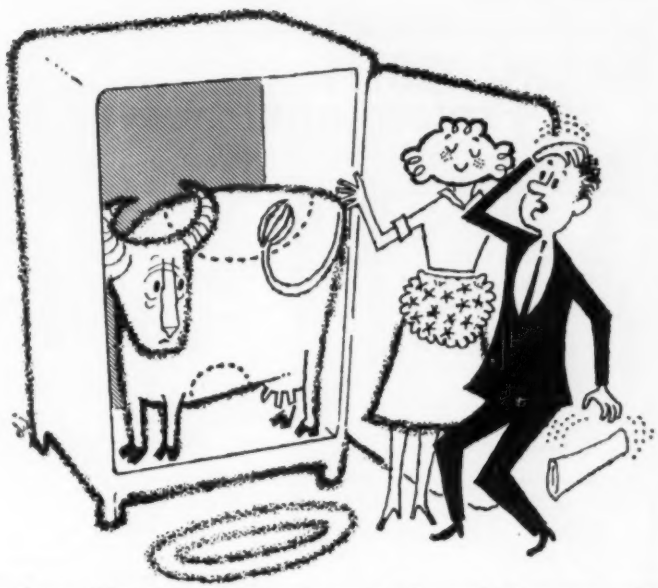
Wilkins of the Magnetic Sound Camera Corp.



A miniaturized studio mixing console has been announced by Magnasync Mfg. Co., 5546 Satsuma Ave., North Hollywood, Calif. It has six input channels and patch bay selection of three program equalizers. The frequency response is 20 to 20,000 c, ±1.5 db; signal-to-noise ratio, 70 db below program level; distortion, less than 0.5% total harmonic; output level, maximum 20 dbm; power consumption, 80 w. It is 34½ in. wide, 24 in. deep, and 14 in. high. The top door is hinged for accessibility to all components.

The TransFlyweight, a lightweight, professional, battery-operated tape recorder has been announced by Amplifier Corp. of America, 398 Broadway, New York 13. Ultra-low noise transistors have been incorporated to achieve a low-equivalent-input noise level of less than 0.25 μv. Mechanical features include a multiple shielded motor with special auxiliary noise suppressors; two-section modular plug-in construction; high-speed electrical rewind; a precision-type adjustable reed-type governor, and transistorized VU indicator. Electrical features include push-pull ultrasonic bias oscillator; direct-coupled three-stage sections; interlooped a-c, d-c feedback; tuned ultrasonic bias high-Q trap; thermal stabilization; segmentized circuit design, and high input dynamic range acceptance.

The Gaumont-Kalee "1690" Sound Recording Unit for the Arriflex 16 camera is available through Camera Equipment Co., 315 W. St., New York 36, recently appointed exclusive United States distributor. The "1690" is a transistorized magnetic sound attachment intended mainly for use in newsreel and documentary photography. It is designed for simplicity and portability and is especially



Why buy the Cow when you only need a quart?

Smart Pros rent their equipment from CECO*

Why invest a lot of money for expensive photographic equipment for which you may have only limited use? Do what the top Pros do—rent your cameras, lighting, sound recording and editing equipment from CECO's vast stocks. Everything is delivered to you "better than new"—because everything is checked out for perfect performance before it goes out on rental. You save on taxes, too. Ask us about rental-lease arrangements.

Cameras
16mm & 35mm—Sound (Single or Double System)—Silent — Hi-Speed

Lenses
Wide angle—Zoom—Telephoto—Anamorphic

Sound Equipment
Magnetic—Optical

Grip Equipment
Parallels—Goboes—Other Grip accessories

Dollies
Crab—Western—Portable—Panoram—Cranes

Lighting
Arcs—Incandescents—Spots—Floods—Dimmers —Reflectors—All Lighting Accessories

Generators
Portable—Truck Mounted

Editing Equipment
Moviolas—Viewers—Splicers—Rewinders

Projection Equipment
16mm & 35mm—Sound & Silent—Slide—Continuous

Television
Closed Circuit TV

*CECO Trademark of Camera Equipment CO

FRANK C. ZUCKER

CAMERA EQUIPMENT CO., INC.

Dept. JS-6 315 West 43rd St., New York 36, N. Y. ● JUdson 6-1420

The ultimate in **DEFINITION!**

The Most Accurate, Optically Perfect, Widest Range Lenses Ever Designed!

COOKE KINETAL

COOKE SPEED PANCHRO SERIES II

For 16mm Arriflex Cameras 16mm Mitchell Cameras 16mm "C" Mount Cameras

For 35m Mitchell Standard NC & BNC Cameras • 35mm B & H Standard Cameras • 35mm Arriflex Cameras • 35mm Eclair Camerette

New Series of COOKE Lenses . . .

We can't help crowing about this latest achievement in lenses by TAYLOR-HOBSON-COOKE. Made of rare earth glasses, their new series is the "latest" word in lens design. Optically and mechanically perfect, they provide the sharpest definition. Ideal for Theatrical or TV Film work. Write for further information today.

CAMERA EQUIPMENT CO., INC.

315 West 43rd Street, New York 36, N. Y.

Professional Services

BERTIL I. CARLSON
Photoproducts Co.
Consultants, designers, builders in PHOTO INSTRUMENTATION
Box 60, Fort Lee, N. J.

COLORTRAN CONVERTER
LIGHTING EQUIPMENT
The most illumination for the least investment
CROSS COUNTRY RENTAL SYSTEM
ELIMINATES COSTLY SHIPPING
write for catalog
NATURAL LIGHTING CORP.
612 W. Elk, Glendale 4, Calif.

J. A. MATTHEWS..... J. B. MINTER
Professional Sound Recording Services:
Disk Mastering, Tape Editing,
Dubbing etc.
COMPONENTS CORPORATION,
Recording Division
Denville, N.J. Oakwood 7-0290

TUFF COAT
Multiplies the useful life of all types of preprint and release film. Protects from scratches and abrasions. Safe, easy to use. Kills static, cleans and lubricates. Special type available for Videotape, Magstripe and Lacquered footage.
Send for Brochure "S"
NICHOLSON PRODUCTS CO.
3403 Cahuenga Blvd. Los Angeles 28, Calif.
Ho. 7-1712

CRITERION
FILM LABORATORIES, INC.
Complete laboratory facilities for 16 & 35mm black-and-white and color
33 West 60th St., New York 23, N. Y.
Phone: COlumbus 5-2180

PHOTOGRAPHIC INSTRUMENTATION
Specializing in
HIGH-SPEED
Motion-Picture Photography
Photographic Analysis Company
100 Rock Hill Rd., Clifton, N. J.
Phone: Prescott 8-6436

ELLIS W. D'ARCY & ASSOCIATES
Consulting and Development Engineers
Xenon-Arc Applications
Motion-Picture Projection
Magnetic Recording and Reproduction
Box 1103, Ogden Dunes, Gary, Ind.
Phone: Twin Oaks 5-4201

PROFESSIONAL MOTION PICTURE PRODUCTION EQUIPMENT
Cameras, Sound Recording, Editing, Laboratory and Affiliated Equip.
Consulting Services by Qualified Engineers
Domestic and Foreign
REEVES EQUIPMENT CORP.
10 E. 52nd St., NYC
Cable: REEVESQUIP

EAGLE FILM LABORATORY, INC.
(Established 1951)
A 16MM SPECIALIST LABORATORY
341 E. Ohio St., Chicago 11, Ill.
WHitehall 4-2295

SUPPLIERS
PHOTOGRAPHIC CHEMICALS
and
Consultants in Photographic Chemistry
L. B. Russell Chemicals, Inc.
14-33 Thirty-First Avenue
Long Island City 6, New York
YEllowstone 2-8500

16mm
Complete Color and Black & White Motion Picture Laboratory Services including Sound Recording
FISCHER PHOTOGRAPHIC LABORATORY, INC.
6555 North Ave., Oak Park, Ill., EUclid 6-6603

FILM PRODUCTION EQUIP.
The world's largest source of supply for practically every need for producing, processing, recording and editing motion picture films.
Domestic and Foreign
S.O.S. CINEMA SUPPLY CORP.
Dept. TE, 602 W. 52 St., N.Y.C.-Cable:SOSOUND
Western Branch: 6331 Holly'd Blvd., Holly'd, Cal.

RENT
16mm, 35mm, 70mm
Motion Picture Cameras
High Speed Cameras
Special Cameras
Lenses
Lights
Processing Equipment
Editing Equipment
GORDON ENTERPRISES
5362 N. Cahuenga, North Hollywood, Calif.

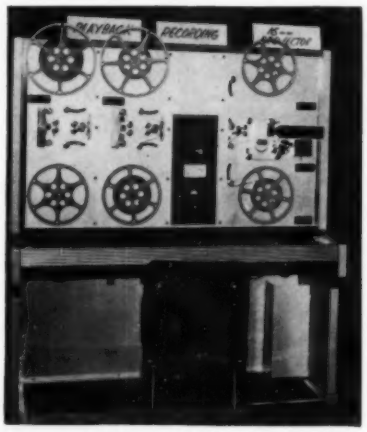
ALL 16mm PRODUCERS SERVICES
Equip. Rentals • Technical Crews
40 × 70 Sound Stage
16mm LABORATORY FACILITIES
Exclusive TRIAD Color Control
Additive Color Print Process, Plus B & W
SOUTHWEST FILM CENTER
3024 Ft. Worth Ave., Dallas 11, Texas

ROCKY MOUNTAIN HEADQUARTERS
For 16mm Film Services
B&W and Anscochrome Processing
Printing—Recording—Editing
Production—Rental—Sales
All types of film in stock
Write for Price List
WESTERN CINE SERVICE, INC.
114 E. 8th Ave., Denver 3, Colo. AMherst 6-3061

Professional cards available to members. 12 insertions, 2x1 in., $60

useful for filmed interviews and on-the-spot news coverage. The unit is mounted between the camera and tripod head. The film is pulled through the soundhead by the take-up and hold-back sprocket on the camera. No other mechanical drive is required.

The 2-channel recording amplifier unit contains the recording amplifier with input mixer for two microphones and also a bias oscillator, monitoring amplifier and a volume indicator drive amplifier. The circuit employs 12 transistors which derive supplies from a 7.5-v battery inside the amplifier chassis. Camera and amplifier may be operated close together or up to 60 ft apart.



Bomar 16mm professional recording equipment for dialogue and mixing has been introduced in the United States by Vicom Inc., 70 Aberthaw Rd., Rochester 10, N.Y. The equipment, exhibited at the SMPTE Convention in Miami Beach, consists of a recording panel, a playoff panel and a continuous projector with optical playback. The three units are mechanically interlocked and are driven from the same sychronous motor. Featured is a floating filter film transport designed to eliminate film stress. Early development of the system was described before the Society's Convention at Washington in 1957 and in the *Journal* in September 1957.

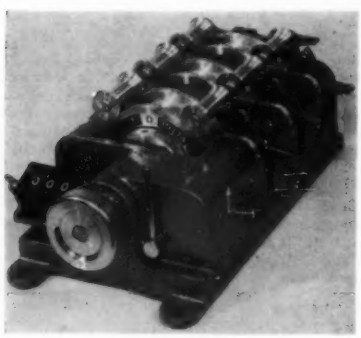
The PM-72 Portable Magnetic Recorder was introduced by Radio Corp. of America at the Society's 85th Convention (Miami Beach, May 5–9). The 40-lb, 12 by 10 by 20-in. unit uses transistorized audio components and can be supplied for 16mm or 17½mm magnetic film. Special clutches are used to drive the film take-up and rewind mechanisms while a simplified switching arrangement places controls within easy reach of the operator. The mixer can be employed in connection with four microphones carrying dialogue, sound effects or background music. The signals from any two of the four microphones can be blended onto the same soundtrack at one time with switching provided to shift the microphone combination.

RCA also exhibited its Dual Dubber designed for studio use, and it was described in a technical paper on the Miami

Beach Program by C. E. Hittle. Two magnetic sound film reproducers are contained in one cabinet to save space. Each reproducer operates independently of the other.

The Wave Dropout Analyzer Model 900, a product of Acoustronics Inc., 156 Olive St., Huntington Sta., N.Y., is designed primarily to determine the quality of magnetic tape by measurement of the dropout characteristics in a magnetic tape recording. The device has an operating range of 7.5 kc to 80 kc. The input impedance is approximately 100,000 ohms. The dropout amplitude calibration range is adjustable from 15% to 85% by means of a front panel calibration control. The dropout width calibration range is adjustable from 360 μsec to 38 μsec. Overall accuracy is within 3%. For each dropout detected with respect to amplitude and width (time duration) a 70-v, positive going, rectangular pulse is emitted. This pulse has a width of 30 μsec. The unit weighs 30 lb and the relay rack measures 19 in. wide, 10½ in. high and 10 1/16 in. deep. The only external equipment required for measuring dropouts is an accessory electronic counter and a sinusoidal signal generator for calibration purposes, which may be the same one used in making the magnetic-tape recordings.

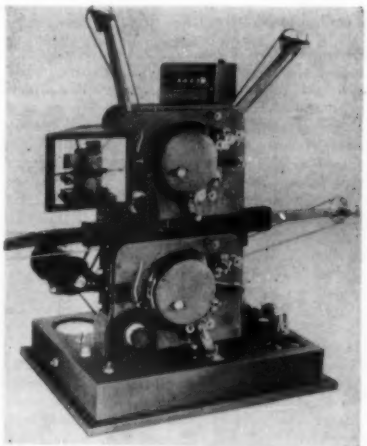
A new 9mm high-intensity positive projector carbon has been announced by National Carbon Co. Division of Union Carbide, 535 Fifth Ave., New York 17. Amperage for the new carbon has been increased from the previous 75 to 85 amperage range to a top of 90 amp to make possible 10% more light at the same burning rate.



Precision Laboratories, a Division of Precision Cine Equipment Corp., 1037 Utica Ave., Brooklyn 3, N.Y., has designed a new line of synchronizers for motion-picture and television applications. The synchronizers are designed for ganging and can be purchased separately for adding as needed.

Two new viewers have been announced by S.O.S. Cinema Supply Corp., 602 West 52 St., New York 19, and were recently shown for the first time at the SMPTE spring convention in Miami Beach in May. The S.O.S. Sr. Viewer shows a 3 by 4 picture, has built-in focusing and framing controls, and will operate on

either 110 or 220 v. An editing pencil can be used directly on the film when the lighthead is lifted; in this position the editing lamp goes off and a work light automatically goes on. The viewer measures 6 by 10 by 10 in. and weighs 7½ lb. It is priced at $135. Combined with a sound reader it forms the S.O.S. Ediola, starting at $357.50. There is also a Junior model of the viewer available.



A portable 16mm double-system editor has been announced by Palmer Editors, Box 535, Radio City Sta., New York 19, The 50-lb machine may be used for either separate or interlocked operation of sound and picture film and it may also be used for standard sound film projection of a 3 by 4-ft picture. Hand-set knobs allow frame by frame movement and a Veeder counter reads in frames and feet and operates in both directions.

The New 1960 Emel Plume 8mm Camera has been announced by Akarex Corp., 80 E. 11 St., New York 3. Designed mainly for use by the advanced amateur, the camera features rewind key for double exposure; individual frame counter; parallax correction to 10 in.; Swedish power torque steel spring; locking turret device, and panning device with instant shutoff, regulated by a spring mechanism above button release. It is priced at $179.50.

You are there – with Cinema...

Professor
PETROV SPACENIK
(Somewhere east of the Oder)

"Is resembling some diabolic Amerikan secret electronik weapon. But what, in Lenin's name? Much too small for second-rate atom bomb. And is much too big for new U. S. satellite. Maybe some crucial rocket part? No, here large-type printing is spelling out CINEMA. Comrade Informer-and-Borrower-for-Peaceful Usage is goofing again. Is not space capsule, but only bourgeois motion picture device from Hollywoodnik. Yes, smaller letters confirm my analysis for also reads MADE IN BURBANK. Is maybe camera? Impossible for so tiny. Or maybe is movie film inside small wire-wound can. Yes, is Short Subject no doubt. Ingeniously clever, this CINEMA."

Wrong, Professor. You're holding one of CINEMA ENGINEERING'S Precision Wire-Wound Resistors used in missiles, computers, laboratory and industrial test equipment. Backed by more than 20 years of scientific experience and customer acceptance, CINEMA'S high-quality resistors stand up to long-range exposure and assure reliable performance. Write for our catalog 14R today.

CINEMA
ENGINEERING
DIVISION AEROVOX CORPORATION
1100 CHESTNUT • BURBANK, CALIF.

CLASSIFIED ADVERTISING
First three lines $5.00
Each additional line $1.00
per inch $13.00

WANTED: 16 or 35mm New or Used B & H Film Printer. Movielab Film Laboratories, Inc., Movielab Bldg., 619 W. 54th St., New York 19, N.Y.

A Vidicon Pan and Tilt Head for motion-picture cameras has been announced by Camera Equipment Co., 315 W. 43 St., New York 36. Originally designed for use with vidicon cameras weighing about 60 lb, it has been tested for motion-picture work. A built-in balance feature counterbalances the weight of the camera. Features include a large pan locking lever which affords sensitive control setting of friction for the operator's panning tension selection. A tilt lock lever provides the same type of friction control as the panning lever. The head fits all professional wooden and all-metal tripods. The head is priced at $325. A wooden tripod is available at a price of $150; the all-metal tripod is priced at $260.

The Angenieux 12.5mm f/1.8 standard lens for the Camex Reflex 8 has been announced by Karl Heitz, Inc., 480 Lexington Ave., New York 17. The lens focuses from infinity to 10 in., while its depth-of-field reaches down to 6 in. Price of camera and lens together is $309.00.

General Film Laboratories, a subsidiary of Pacific Industries, Inc., has announced expansion into the Midwest with the establishment of facilities in the Power and Light Bldg., Kansas City, Mo. Announcement was made by G. Carleton Hunt, President of the laboratories. Neal Keehn, formerly with Calvin Co., will be in charge of the new operation. Initially the new facilities will consist of cutting room, projection room and other producers services. The possibility of the addition of processing operations is contemplated.

Signal dropouts in magnetic tape are discussed in a 4-page bulletin, *Reduction of Dropout Errors in Magnetic Recording Systems*, Bulletin No. 37 in the *Sound Talk* series, available upon request from Minnesota Mining and Mfg. Co., Dept. E9–200, 900 Bush Ave., St. Paul 6, Minn. The booklet is illustrated with photomicrographs of common types of coated-in tape flaws, and photographs showing the effect of small dust specks on recorded data tracks.

Some Sources of 2 × 2 Color Slides (S-2), a 12-page pamphlet containing a list of producers and distributors of color slides, published by Eastman Kodak Co., is available in a revised edition. Fifty-eight firms in the United States, Alaska, Hawaii, Cuba, Mexico and Norway are grouped according to the general type of slides provided by each firm. The booklet is available without charge from Sales Service Div., Eastman Kodak Co., Rochester 4, N. Y.

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Motion-Picture Engineer. 25 yrs responsible positions in large organizations. Expert in all technical phases motion-picture laboratory color or B&W. 2 yrs as technical director and sales engineer for representative of well-known motion-picture equipment. Motion-picture consultant to U.S. Govt. agencies in Washington. Will accept responsible position supervising laboratory operations in management, quality control, install new laboratories, etc., or as technical sales representative for motion-picture equipment. Will consider most sections of U.S. or certain overseas assignments. Excellent knowledge of three languages. U.S. citizen. Write: E.C.C., First Floor, 219–47 74th Ave., Bayside 64, L.I., N.Y.

Writer-Director. Experienced, imaginative, desires position with active motion-picture unit. Experience includes writing, directing and editing documentary films on agricultural and engineering subjects. 29, married, B.A. Penn State. Resume and samples available. Ted Kliman, 206 McDonald St., Blacksburg, Va. PR 2-8261, Ext. 452.

Director-Producer of business films and TV commercials in New York and Mexico City. 35, married, one child. 13 yrs experience in all phases film activity: writing, directing and producing, as well as handling clients and directing office details. Planning to return to U.S. April 30 after completing one yr assignment Mexico City reorganizing local film concern. Full command of Spanish, some Portuguese. Seek permanent position as director and/or production manager with film producer or advertising agency. Willing relocate anywhere in U.S. or Mexico. Have Mexican working papers. Write to: Frank J. Maguire, 35–45 78 St., Jackson Heights 72, N.Y.

Director-Cameraman, Editor of nontheatrical films. Experienced in all phases of production. Employed by Audio Visual Service USOM/L c/o American Embassy in Beirut, Lebanon as Program Advisor, Film Production Supervisor of 16 & 35mm Films. Now in U.S., wishes position with production company. Young (26), married, willing to relocate. Resume on request. Write: Hrayr Toukhanian, 305 Hyde St., San Francisco 9, Calif.

Motion-Picture Cameraman, Director, Technician. 13 yrs experience in photography, last 9 yrs in motion pictures with both 35 & 16mm on location and sound stage; lighting; film editing; directing; processing; customer relations; cost-time estimates; high-speed, micro and macro photography. Presently employed with large industrial firm. Desires position in motion-picture field. Age 27, married, willing to relocate. Resume on request. Write: William C. Mace, Jr., 308 Benham, Richland, Wash.

Industrial Photographer, Manager, Producer. Also experienced in lab management. Desires position with vigorous film production outfit in either production or organization. Will accept heavy project responsibility. Presently serving with U.S. Army Signal Corps as Chief, Motion Picture Branch, Signal Missile Support Agency, White Sands Missile Range. Prior service at Army Pictorial Center, New York, with chief duties to coordinate the maintenance, modification, design and installation of lab equipment. Thoroughly familiar with military photographic requirements. Experienced in all phases of motion-picture production. Single, willing to relocate. Military service ends July 31. Resume on request. Write: Lt. Avrum M. Fine, Navy BOQ, White Sands Missile Range, New Mexico.

Motion Picture Cameraman, Technician. 7 years actively engaged in 16mm motion-picture work. For the last 4 yrs have been employed as head of technical operations of a company producing films primarily for TV and educational usage. Experience includes work in practically every technical phase of motion-picture production. Desire connection with a producer of industrial, education, scientific or travel films. Age 30 and an active member of SMPTE. Résumé on request. G. Kenneth Futrell, 678 Pope Street, Memphis 12, Tenn.

Engineering Aide. 32 yrs talkies, radio, audio, magnetic tape, intercom. Attending night school for degree. Desires R&D position with sound or cine organization. Salary $2.35 per hour. Teachable, studious, no drink or smoke. Los Angeles only. Frank W. Mango, 1211 N. Berendo St., Los Angeles 29.

Audio-Visual Aids Specialist. Six yrs experience full-time with City of N. Y. in the City Colleges and 3½ yrs as supervising technician at Columbia Univ. and NYU. Matriculated university student with courses in cinematography, motion-picture production and its history. Considerable experience with operation of 16mm sound projectors, operation and service of filmstrip and slide projectors, professional tape recorders. Demonstration of audio-visual equipment to prospective teachers or college faculty and students. Richard I. King, 270 Convent Ave., Apt. 8E, New York 31. WA 6-1910.

Projectionist. 19 yrs experience in booth operation and theatre projection. Experienced with 70mm, 35mm and 16mm—optical and magnetic sound—indoor and drive-in theatres. Age 37, single. Desires position with foreign service. Member IATSE and SMPTE. Write: E. O. Hepler, Jr., 15 Morningside Drive, Boonville, Mo.

Motion Picture Production. Extremely creative, energetic. 7 yrs heavy experience in film production, studio and location, educational, industrial and TV films. Created, photographed and edited 22 TV commercials for one of America's top toy companies. Desires position with Ad Agency, live studio or TV Station. Age 26, Vet and Single. Willing to travel throughout the world. Resume and references on request. Write FILM, 3738 Cypress Ave., Brooklyn 24, N.Y

Motion-Picture or Television Production. Graduate New York Univ., B.A. Communication Arts. Experienced all phases motion-picture and television production. Seeking permanent position with television or motion-picture production organization. Willing to relocate. Résumé on request. Write: Walter Bleich, 2700 Marion Ave., New York 58.

Assistant to Director or Producer. Former instructor in motion pictures, Theater Arts Dept., Univ. of California, Los Angeles, desires position as personal assistant to a director or producer of feature films. Background includes: B.A. in Motion Pictures, 3 years teaching all phases of motion-picture production, second unit direction of a Disney "true-life adventure," and director of photography on dramatic and documentary films. Willing to travel. Available for interview in Los Angeles area. For references and detailed résumé write: William R. Lieb, 140½ W. Foothill Blvd., Claremont, Calif. Tel: NAtional 4-4166.

Editor-Cameraman. Over 10 yrs solid production experience in New York with quality producers of industrial, business and television films. Seek staff position. Résumé available. Member SMPTE since 1948. No other affiliations. Joe M. Wolff, 43-31 Ithaca St., Elmhurst, N.Y.

Positions Available

Production Center. Growing educational 16mm film production, teaching and research center with own lab needs versatile man to take charge in June. Requires all-round film man able to handle lab as well as production aspects. Call or send resume to: Dr. Sydney W. Head, Director, Broadcasting & Film Services, University of Miami, Fla.

Sales and Applications Engineer. Man now living or willing to live in or near Washington D.C., or New York City, to represent Western photographic instrumentation firm selling airborne and ground data-recording equipment. Experience in military and industrial test instrumentation field, with optical and electronic background most desirable. Address initial inquiry with brief outline of background to: Mark MacIntosh, V.P., Traid Corp., 17136 Ventura Blvd., Encino, Calif., who will arrange interviews in Washington, New York or Encino.

Sound Engineer. Expanding 16mm film prod. company and laboratory wants man to take over its sound recording dept. Must have electrical engineering background, with knowledge of 16mm optical film recording using Maurer equipment. Work involves studio and location recording on ¼-in. tape and 16mm magnetic equipment, mixing magnetic tracks to master magnetic or optical tracks, disk recording, installation of new equipment, maintenance, etc. In application give age, education, experience, and salary requirements. Western Cine Service, Inc., 114 East 8th Ave., Denver 3, Colo.

Editor-Cameraman, for 4-man educational film unit. Requirements: 4 yrs experience or 4 yrs college major in cinema plus 2 yrs experience. Primary duties in all phases of editing; secondary duties as assistant to first cameraman. Modern equipment. Starting salary $5160 a year. Send résumé and references to Leonard Pullen, Acting Production Supervisor, V.P.I. Motion Picture Unit, Virginia Polytechnic Institute, Blacksburg, Va.

Writer-Director, for 4-man educational film unit. Requirements: 4 yrs experience or 4 years college major in cinema plus 2 yrs experience. Duties: research subject matter, all phases scripting, direct action during shooting. Starting salary $5160 year. Send résumé and references to Leonard Pullen, Acting Production Supervisor, V.P.I. Motion Picture Unit, Virginia Polytechnic Institute, Blacksburg, Va.

Film Inspectors. Temporary or permanent. Write or call Peerless Film Processing Corp., 165 W. 46 St., N. Y. 36. Tel. PLaza 7-3630. Att: Kern Moyse.

Cinematographers to assume responsibility for current motion-picture projects in military sales promotion, R & D film progress reports, public relations, etc. Three yrs experience as senior motion-picture cameraman needed. **Senior Motion-Picture Film Editor** responsible for editing completely integrated motion pictures including sound if required. Three yrs practical experience as editor required. Send complete resumes to R. C. Dunnuck, Engineering Personnel, North American Aviation, Inc., 4300 East Fifth Ave., Columbus 16, Ohio.

Motion-Picture Laboratory Printing Room Night Supervisor to oversee production problems and rates. Must be completely familiar with laboratory printing operation. Salary open. Contact Robert Crane, Color Service Co., Inc., 115 West 45 St., New York 36. JUdson 6-0853.

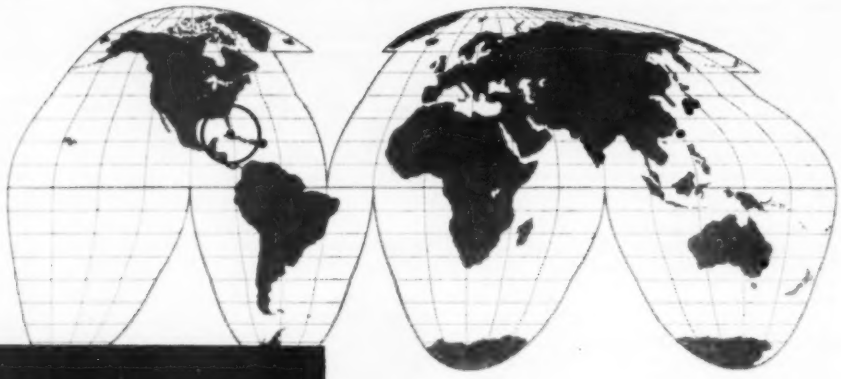
Chief Engineer. Immediate opening. Responsibilities include the administration of a staff of engineers designing electro-mechanical products for commercial and military application. Located in the Los Angeles area. Please reply in writing to W. C. Heath Associates, Inc., Room 526, 714 West Olympic Blvd., Los Angeles 15, Calif.

Audio Repair Man. Thoroughly experienced on magnetic tape recorders, projector and Moviola amplifiers, etc. Knowledge of motion-picture sound equipment essential. Good salary. Write fully to Arthur Florman, Florman & Babb, Inc., 68 West 45 St., New York 36.

Motion-Picture Equipment Salesman. Knowledge of all professional production equipment. Outside sales, to visit film producers, industrial accounts, etc. Fully exerienced. Good salary. Write fully to Arthur Florman, Florman & Babb, Inc., 68 West 45 St., New York 36.

Recording Engineer. To serve as head of electroacoustics laboratory involving duties in the fields of audio-video, acoustics and recording systems. Must be able to render consultation services in connection with research and development on related electronic systems and programs. Degree plus 3 yrs professional experience in above fields required. Salary $8810 per annum. Position is in Federal Career Service. Send SF-57 "Application for Federal Employment," obtainable at any Post Office, to Employment Superintendent, U. S. Naval Training Device Center, Port Washington, N.Y.

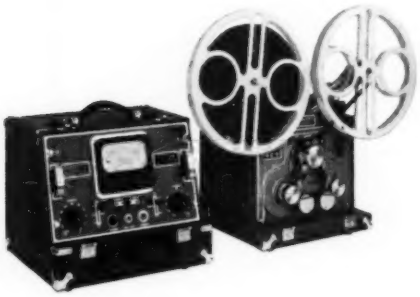
AROUND THE WORLD WITH MAGNASYNC



havana (Cuba)

Eldorado Pictures Corp. of Cuba, with main studios in Havana, is completely equipped with Magnasync-Magnaphonic sound systems. Photo at left, taken at the Biltmore Studio, Havana, shows the sound Supervisor, Charles Stapler, demonstrating recording techniques to Teresita, Cuban actress; Wm. Stutz and D. J. White, Magnasync executives; Al Stetson, grip; Charles Maguire, production manager, and C. B. Newbery, producer of "Kiss Her Goodbye", the feature now in production.

Inset photo shows Stapler and three "barbudos" (the bearded ones) ... part of the Biltmore Studio's armed guard which is still necessary in post-revolution Cuba.



Among the portable Magnasync equipments in use at Eldorado Pictures, the 17½ mm Type 1 is outstanding; its low power consumption, extreme portability, built-in footage counter and power amplifier, and plug-in audio make this 39 lb. unit a popular selection for remote location production.

Write, wire or phone

MAGNASYNC MANUFACTURING CO., LTD.

5546 Satsuma Ave., North Hollywood, California • STanley 7-5493 • Cable "MAGNASYNC"

International leaders in the design and manufacture of quality film recording systems

DEALERS: **CHICAGO,** Zenith Cinema Service, Inc.; **LOS ANGELES,** Birns & Sawyer Cine Equipment; **NEW YORK,** Camera Equipment Co.; **SAN FRANCISCO,** Brooks Camera Co.; **BELGIUM,** Brussels, S.O.B.A.C., S.A. (Societe Belge D'Applications Cinematographiques); **BOLIVIA,** La Paz, Casa Kavlin; **BRAZIL,** Rio de Janeiro, Mesbla, S.A.; **CANADA,** Toronto, Ontario, Alex L. Clark, Ltd.; **DENMARK,** Copenhagen, Kinovox Electric Corp.; **ENGLAND,** London, W-1, Delane Lea Processes, Ltd.; **HONGKONG,** Supreme Trading Co.; **INDIA,** Bombay, Kine Engineers; **ITALY,** Rome, Reportfilm S.R.L.; **JAPAN,** Tokyo, J. Osawa & Co., Ltd.; **MEXICO CITY,** D.F., Henri A. Lube; **PAKISTAN,** Karachi 3, Film Factors Ltd.; **SWITZERLAND,** Zurich 7/53, Rene Boeniger; **THAILAND,** Bangkok, G. Simon Radio Co., Ltd.

Contents — pages 426 – 454

News Columns

Papers Program for the 86th Convention 426
85th Convention, Miami Beach 427
SMPTE Test Films. 430
Education, Industry News 432
Section Reports 436
Obituary: William J. Morlock 442
Current Literature 442
New Products 444
Employment Service 452

Advertisers

Berndt-Bach, Inc. 443
Camera Equipment Co. 449
Camera Mart, Inc. 436
Cinema Engineering Div.. 451
Classified. 452
Electronic Applications, Inc.. 432
Filmline Corp. 453
Gevaert Photo-Producten N. V.. 437
Hollywood Film Co.. 441
Houston Fearless Corp. 431
Kling Photo Corp. 445
Magnasync Mfg. Co., Ltd. 454
Motion Picture Laboratories, Inc. 440
Movielab Color Corp. 439
Moviola Mfg. Co. 447
Peerless Film Processing Corp. 438
Professional Services 450
L. B. Russell Chemicals, Inc.. 435
SMPTE. 433, 434
S.O.S. Cinema Supply Corp. 442
Studio Supply Co. 448
Tri Art Color Corp.. 446

Meeting Calendar

National Audio-Visual Association Convention and Exhibit, July 25–28, Morrison Hotel, Chicago.

Society of Photographic Instrumentation Engineers, National Meeting, Aug. 4–7, Ambassador Hotel, Los Angeles.

WESCON, Aug. 18–21, Cow Palace, San Francisco.

AIEE, Petroleum Industry Conference, Aug. 25–27, Wilton Hotel, Long Beach, Calif.

Mathematical Association of America, Summer Meeting, Aug. 31–Sept. 3, Univ. of Utah, Salt Lake City, Utah.

New York State Society of Professional Engineers, Autumn Meeting, September, Niagara Falls, N. Y.

Illuminating Engineering Society, Annual National Conference, Sept. 7–11, Fairmont & Mark Hopkins Hotels, San Francisco.

American Institute of Electrical Engineers and National Electrical Manufacturers Association, National Electrical Insulation Conference, Sept. 9–11, Chicago, Ill.

Society of Plastics Industry, Midwest Section Conference, Sept. 10, 11, French Lick, Sheraton Hotel, French Lick, Ind.

American Chemical Society, National Meeting, Sept. 13–18, Atlantic City, N.J.

Standards Engineers Society, Annual Meeting, Sept. 21–23, Somerset Hotel, Boston, Mass.

Instrument Society of America, Annual Instrument-Automation Conference and Exhibit, Sept. 21–25, International Amphitheatre, Chicago, Ill.

IRE, Conference on Non-Linear Magnetics and Magnetic Amplifiers, Sept. 23–25, Shoreham Hotel, Washington D.C.

AICE, Sept. 27–30, St. Paul Hotel, St. Paul, Minn.

National Symposium on Telemetering, Sept. 28–30, Civic Auditorium and Whitcomb Hotel, San Francisco.

IRE and AIEE, Industrial Electronics Conference, Sept. 30–Oct. 2, Muelbach Hotel, Kansas City, Mo.

IRE, Aeronautical Communications Symposium, Oct. 5–7, Hotel Utica, Utica, N. Y.

86th Semiannual Convention of the SMPTE including Equipment Exhibit, Oct. 5–9, Statler Hilton Hotel, New York.

IRE Canadian Convention, Oct. 7–9 Toronto, Ont.

Optical Society of America, Annual Meeting, Oct. 8–10, Chateau Laurier Hotel, Ottawa, Ont

ASCE, Los Angeles Convention, Oct 9–13, Hotel Statler, Los Angeles.

AIEE, Fall General Meeting, Oct 11–16, Chicago

National Electronics Conference, Oct. 12–14, Hotel Sherman, Chicago.

National Society of Professional Engineers, Fall Meeting, Oct. 15–17, Olympic Hotel, Seattle Wash

ASCE, Annual Convention Oct 19–23, Hotel Statler, Washington, D. C.

American Standards Association, National Conference on Standards, Oct. 20–22, Sheraton-Cadillac Hotel, Detroit, Mich.

Acoustical Society of America, Fall Meeting, Oct. 22–24, Wade Park Manor Hotel, Cleveland, Ohio.

Society of Photographic Scientists and Engineers, Oct. 26–30, Edgewater Beach Hotel, Chicago

IRE, Electron Devices Meeting, Oct. 29–31, Shoreham Hotel, Washington, D. C.

Louisiana Polytechnic Institute, Instrumentation Conference, Nov. 5 6, Ruston, La.

IRE, Instrumentation Conference, Nov. 9–11, Atlanta, Ga

Sixth National Symposium on Reliability and Quality Control, Jan. 11–13, 1960, Statler Hilton Hotel, Washington, D.C.

IRE National Convention, Mar. 21–24, 1960, Coliseum and Waldorf-Astoria Hotel, New York.

87th Semiannual Convention of the SMPTE, May 1–7, 1960, Ambassador Hotel, Los Angeles.

88th Semiannual Convention of the SMPTE, and

Fifth International High-Speed Congress and Equipment Exhibit, Oct. 16–22, 1960, Sheraton-Park Hotel, Washington, D.C.

89th Semiannual Convention of the SMPTE, Spring, 1961, Royal York, Toronto.

90th Semiannual Convention of the SMPTE, Oct. 15–20, 1961, New York.

SMPTE Officers and Committees: The rosters of the Officers of the Society its Sections, Subsections and Chapters, and of the Committee Chairmen and Members were published in the April 1958 Journal Part II.

sustaining members

of the Society of Motion Picture and Television Engineers

The objectives of the Society are:

- Advance in the theory and practice of engineering in motion pictures, television and the allied arts and sciences;
- Standardization of equipment and practices employed therein;
- Maintenance of high professional standing among its members;
- Guidance of students and the attainment of high standards of education;
- Dissemination of scientific knowledge by publication.

Progress toward the attainment of these objectives is greatly aided by the financial support provided by the member companies listed below.

Acme Film Laboratories, Inc.
Alexander Film Co.
Altec Service Company
Altec Lansing Corporation
Ampex Corporation
Animation Equipment Corp.
Ansco
C. S. Ashcraft Mfg. Co.
The Association of Cinema Laboratories, Inc.
Association of Professional Cinema Equipment Dealers of New York
Camera Equipment Company, Inc.
The Camera Mart, Inc.
Florman & Babb, Inc.
National Cine Equipment, Inc.
S.O.S. Cinema Supply Corporation
Atlas Film Corporation
Audio Productions, Inc.
The Ballantyne Company
Bausch & Lomb Optical Co.
Bell & Howell Company
Berndt-Bach, Inc.
Burnett-Timken Research Laboratory
Byron Motion Pictures, Inc.
S. W. Caldwell Ltd.
The Calvin Company
Capital Film Laboratories, Inc.
Oscar F. Carlson Company
Century Lighting, Inc.
Century Projector Corporation
Cineffects, Inc.
Cinesound, Ltd.
Geo. W. Colburn Laboratory, Inc.
Color Reproduction Company
Color Service Company, Inc.
Columbia Broadcasting System, Inc.
CBS Television Network;
CBS Television Stations; CBS News;
CBS Film Sales; Terrytoons
Comprehensive Service Corporation
Consolidated Film Industries
Dage Television Division of Thompson Ramo Wooldridge Inc.
Andre Debrie Mfg. Corp.
DeFrenes Company
DeLuxe Laboratories, Inc.
Desilu Productions, Inc.
Du Art Film Laboratories, Inc.
Dupont Company of Canada, Ltd.
E. I. du Pont de Nemours & Co., Inc.
Eastern Effects, Inc.
Eastman Kodak Company
Electronic Systems, Inc.
Elgeet Optical Company, Inc.
Max Factor & Co.
Filmline Corporation
General Electric Company
General Film Laboratories Corporation
General Precision Laboratory Incorporated
W. J. German, Inc.
Gevaert Photo-Producten N. V.
Guffanti Film Laboratories, Inc.
The Harwald Co., Inc.
Frank Herrnfeld Engineering Corp.
Hollywood Film Company
Hollywood Film Enterprises, Inc.
Houston Fearless Company
Hunt's Theatres
Hurley Screen Company
JM Developments, Inc.
The Jam Handy Organization, Inc.
Jamieson Film Co.
The Kalart Company, Inc.
Victor Animatograph Corporation
Kling Photo Corp. (ARRI Div.)
Kollmorgen Optical Corporation
Laboratoires Cinématographiques CTM, S. A.
Lorraine Orlux Carbons
Magno Sound, Inc.
J. A. Maurer, Inc.
Precision Film Laboratories, Inc.
Minnesota Mining & Manufacturing Co.
Mecca Film Laboratories, Inc.
Mitchell Camera Corporation
Mole-Richardson Co.
Motion Picture Association of America, Inc.
Allied Artists Products, Inc.
Columbia Pictures Corporation
Loew's Inc.
Paramount Pictures Corporation
RKO Radio Pictures, Inc.
Twentieth Century-Fox Film Corp.
United Artists Corporation
Universal Pictures Company, Inc.
Warner Bros. Pictures, Inc.
Motion Picture Printing Equipment Co.
Movielab Film Laboratories, Inc.
Moviola Manufacturing Co.
National Carbon Company, A Division of Union Carbide and Carbon Corporation
National Screen Service Corporation
National Theatre Supply Company
Northwest Sound Service, Inc.
Panavision Incorporated
Pathé Laboratories, Inc.
Warren Conrad Portman Company
Prestoseal Mfg. Corp.
Producers Service Co.
Rank Precision Industries Ltd.
Reid H. Ray Film Industries, Inc.
Reeves Sound Studios, Inc.
Charles Ross, Inc.
L. B. Russell Chemicals, Inc.
Ryder Sound Services, Inc.
Shelly Films Limited (Canada)
Southwest Film Laboratory, Inc.
The Strong Electric Company
Technicolor Corporation
Titra Film Laboratories, Inc.
Trans-Canada Films Ltd.
Tri Art Color Corporation
Van Praag Productions
Alexander F. Victor Enterprises, Inc.
Westinghouse Electric Corporation
Westrex Corporation
Wilding, Inc.
Wollensak Optical Company

The Society invites applications for Sustaining Membership from other interested companies. Information may be obtained from the Chairman of the Sustaining Membership Committee, Byron Roudabush, c/o Byron Motion Pictures, Inc., 1226 Wisconsin Ave., N.W., Washington 7, D.C.